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VIEWS, NEWS AND INTERVIEWS.

A motor cradle is the latest domestic invention, and a strong-minded lady who has purchased one declares that if science goes on much longer with improvements of that kind there will soon be nothing left for her husband to do. The thing is said to be a great advance on the hand-rocker article, and can be worked with either electricity or petroleum. The motion, says a London paper, may be accelerated or slackened by simply turning a screw, and one great advantage is that the berceuse does not cease swinging though the baby may be left in the room alone. There are, of course, doctors who say that a child should not be rocked at all, but few mothers are of the same opinion, and with the majority the motor cradle will no doubt become popular.

It is stated that the authorities at Scotland Yard, London, are now engaged in subjecting a police electric lamp to practical tests, to ascertain if it will stand the necessary wear and tear of the service.

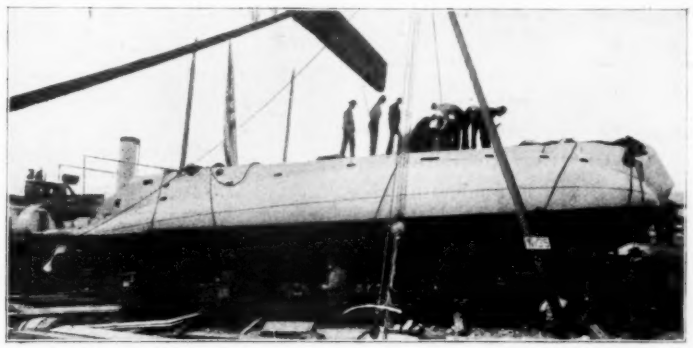
According to a daily paper, detective George S. Docherty, who has been working on the murder of George R. Blodgett ever since it occurred in Schenectady, N. Y., on December 3 last, believes that at last he has found the key to the mystery. Mr. Blodgett, who was a patent attorney for the General Electric Company, was shot by a burglar while defending his property, and died two days later. A reward of $5,000, offered by the General Electric Company, brought a score of detectives to Schenectady. They all worked in vain, however, for there apparently was not the slightest clue. All gave up the task except Docherty, and he believes now that when he had William, alias "Buck," Davis arrested in Troy, N. Y., on March 26, he landed a participant in the crime. Davis is said to have a bad record, and to have been in Schenectady the day before the murder was committed. He was arrested on a bench warrant charging burglarly and larceny on May 14, 1891. The real reason for his arrest, however, is said to be that the evidence against him in the Blodgett murder had become so strong that Docherty thought he would put him in a place where he could place his hands on him when he wanted him.

Boston's subway is nearly completed from end to end. Cars are expected to be running through the great underground passage by September. The sections from Park street to Haymarket square are ready for interior finishing, and car tracks will soon be laid. The work on the subway began March 28, 1895, was completed to Tremont and Boylston streets September 1, 1897, and to Park street September 30. The total length of the 13 sections is 8,958 feet. The time set for completion of the whole subway is September 1, 1898. The estimated cost is $5,000,000.

It is reported that the third-rail electric system from Hartford to Bristol, Ct., will be in operation on the New York & New England Railroad by June 1.

Notice has been given by the United States Lighthouse Board that on June 1 the first order fixed white light in the southerly tower of the Highlands at Navesink, entrance to New York Harbor, will be permanently discontinued. There will be established in the tower, in place of the discontinued light, an electric light showing a white flash of about one-tenth of a second duration every five seconds. The height of the focal plane of the electric light above mean high water will be the same as that of the present light, 246 feet, and the light will be directly visible 22¼ nautical miles in clear weather, with the observer's eye 15 feet above the sea. Under certain conditions, the reflection of the light in the sky will be visible at a greater distance. The present first order fixed white light in the northerly tower will be continued until further notice.

New Orleans street-car conductors have a champion in a Northern woman, who entered a car, and kicking off her muddy goloshes, placed them beside her feet. To her great surprise, says a daily contemporary, the conductor produced a newspaper, and with the air of a gallant gentleman asked that he be permitted to wrap up the overshoes for her. He made a neat package, and now she says that New Orleans street-car conductors are the most polite she has ever met.



THE SUBMARINE TORPEDO BOAT "HOLLAND," OPERATED BY ELECTRICITY.

Christopher Bolte was the driver of a New York cross-town car, and on December 10, 1895, he was run into by a Third avenue cable car at Ninth street. He was injured about the head and back and received a lesion of the brain, which caused paralysis of the left side. After a six-day trial before Justice Dugro in the Supreme Court, he has recovered a verdict for $11,675 damages.

THE SUBMARINE TORPEDO BOAT "HOLLAND."

ELECTRICAL FEATURES OF THE NEWEST ENGINE OF WAR.

The general public is by this time tolerably familiar with the submarine boat recently completed and launched at the Nixon shipyard at Elizabethport, N. J. The boat was built from the designs of the J. P. Holland Submarine Torpedo Boat Company under a contract with the United States Government, and the Navy Department has carefully watched the developing experiments which have resulted in the construction of what appears to be a successful submarine craft. The details of her construction have been skilfully concealed from prying eyes, and the exact interior arrangement is known only to those who have been concerned with her building. The ELECTRICAL REVIEW, however, has been able to secure for its readers the following facts regarding the electrical equipment of the "Holland."

The boat is about 56 feet long, and, as will be observed from the accompanying illustration, resembles a cigar in shape. The boat is propelled by a single screw, and the means adopted for controlling her direction and speed when under water are at once simple, ingenious and effective. The "Holland's" armament consists of an 18-inch torpedo expulsion tube opening at the bow of the boat. Three automobile torpedoes are carried aboard. There is also an eight-inch aerial torpedo gun which will throw an 80-pound dynamite shell over a mile and one-half. Pointing aft is a submarine gun capable of discharging an 80-pound dynamite shell 800 yards under water with a high velocity. These guns are all operated by compressed air. There is room on the boat for 20 dynamite shells. A crew of five men is required to operate the "Holland," and her chief value, it is expected, will consist in her ability to discharge her guns while submerged. The normal speed of the "Holland" is nine knots an hour for six hours, with an expenditure of 50 horsepower, although on spurts the speed

can be increased to 12 knots for short periods of time.

So far no successful plan for running a submarine boat by any other means than the electric current has been successfully employed. The compactness and effectiveness of the storage battery system installed on the "Holland" may be understood when it is stated that to store enough air to operate such a boat would require apparatus weighing at least six times as much. Besides this the pneumatic system involves numerous mechanical difficulties and a much lower efficiency. The electrical equipment of the "Holland" is chiefly remarkable for the amount of power developed from the apparatus contained in a limited space. Everything concerning the operation of the boat has been refined to a minimum, and this is especially true of the electrical devices.

Current for the operation of the boat is supplied from a storage battery composed of 60 special-type chloride accumulators manufactured by the Electric Storage Battery Company, of Philadelphia. These cells are built solidly into one compartment 15 feet long, 6 feet wide and 30 inches high. The weight is so distributed that the batteries are held firmly in any position and can not be thrown out of alignment or crushed by their own weight. The storage battery compartment is located about the center of the boat and is bounded on each side and below by compartments containing water ballast, and is covered with a deck.

The total battery weight is 45,000 pounds, and the cells are capable of discharging 300 amperes per hour for six hours. On spurts of speed lasting for about half an hour the discharge rate may be increased to 1,000 amperes per hour. The battery cells are constructed of steel, lined both inside and outside with lead. The plates are secured in the cells against any possible motion, and the cells are firmly secured in the battery compartment. The cells are constructed in such a manner that the boat can roll or pitch 25 degrees without spilling the electrolyte.

The batteries are charged by means of a gasoline engine and dynamo set. Charging is done only when the boat is on the surface of the water. An arrangement of special gearing permits the 50-horse-power Otto engine to run the dynamo or to turn the propeller shaft in case of emergency. If the boat were running on the surface, the gasoline engine is capable of operating it for 1,000 miles at eight knots an hour with the amount of fuel carried. The dynamo is a special machine, constructed by the Electro-Dynamic Company, of Philadelphia, and has two commutators and a double-wound armature. The normal capacity of the machine is 50 horse-power. Its weight is 3,500 pounds and the armature speed is 800 revolutions per minute. The dynamo is capable of being overloaded to 150 horse-power for two hours at a stretch without an excessive rise of temperature.

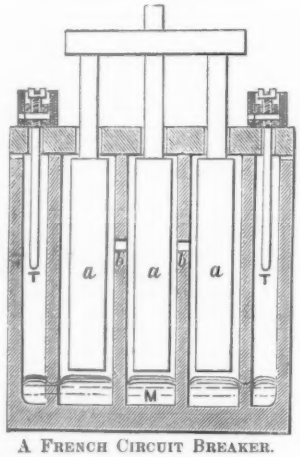
The other electrical apparatus on the "Holland" consists of a 10-horse-power motor used for running a seven-horse-power Ingersoll & Sargent air compressor which is capable of supplying to the storage reservoirs 30 cubic feet of air at 2,000 pounds pressure. This motor is also used to operate a bilge pump. A one-half-horse-power motor is used to ventilate the boat while submerged, by forcing the foul air out into the water, its place being taken by fresh air from the reservoirs. Another one-half-horse-power motor is used to ventilate the storage battery compartment by means of a suction blower for carrying off the battery fumes during charging.

Edison Ore-Separating Process at the Electrical Exhibition.

A great deal of public interest attaches to the work which Mr. Edison has been doing for some years past in magnetic ore separation, and the general curiosity on the subject will be satisfied at the approaching exhibition, where Mr. Edison will actually exhibit a model built for him by Mr. Sigmund Bergmann, which illustrates admirably the fundamental principles of the process. This model will be kept running by a small motor, and the iron will be continuously separated from the crushed rock in full view. Mr. W. S. Mallory, the manager of Mr. Edison's mining works, is sending to the exhibition samples of crushed rock in its various stages, as well as samples of the separated ore and of the briquettes which are sent to the furnace. He is supplementing this by some four or five-ton masses of rock, which Mr. Edison takes bodily out of the hillside by means of huge excavators, and the magnetic condition of these ponderous masses will be shown and tested by magnets. Around the exhibit will be placed photographs illustrative of the scenes at the mines themselves, and the whole will constitute one of the most instructive demonstrations possible.

French Circuit Breakers.

At a meeting of the Société Internationale des Electricians, held at Paris, France, on March 2, our London namesake reports that M. Janet presented, in the name of M. Bouchet, various interrupters and circuit breakers based on a new mode of breakage. In a box made of insulating material are arranged two cavities separated by an insulating partition; they are filled with mercury up to a certain height; if a plunger is inserted into each cavity, the mercury rises, flows over the insulating partition and closes the circuit. In the same way, in withdrawing the plungers, the mercury separates, returns into each cavity and cuts the circuit. It might be feared that the mercury,



A FRENCH CIRCUIT BREAKER.

bringing impurities with it, would leave a trail behind it, but experience has shown that after a long period of working—1,000 breaks, for instance—the traces left behind by the mercury were not sufficient to close the circuit.

On the basis of the above principle the inventor has constructed various models of interrupters. It is only necessary to put a lid on the box of insulating material; in the center is a lever for working the plungers. This lid has on its sides two metal rods connected with external terminals. The mercury, as it rises, touches these rods and closes the circuit; we therefore get closing and breaking at three points.

M. Barbarat has arranged an interrupter (shown in the illustration herewith) with three plungers, *a*, *a*, *a*, for high tensions, and with two insulating partitions, *b*, *b*. This apparatus has been tried with alternating currents at 12 amperes and 3,000 volts on the sector of the Champs Elysées. Magnetic circuit breakers have also been constructed with this mode of breaking. For this purpose a rod of iron is connected with the dippers, and is displaced within a solenoid traversed by the current. The mechanism is arranged so that the action of the electro-magnet on the armature is balanced at the beginning by the weight. As soon as the movement has begun, two springs, placed at the sides and immediately set free, continue it and raise the rod so as to bring about the breaking.

Various other instruments have been constructed, in particular an interrupting circuit breaker and minimum circuit breaker. Two electromagnets have also been arranged one above the other; one to make and one to break the circuit. Thus the interrupter can be worked from a distance. M. Janet has worked in this manner the interrupter of a circuit of 100 lamps.

Wireless Telegraphy Discussed by the New York Electrical Society.

A meeting of the New York Electrical Society was held Wednesday evening, March 30. Dr. Michael I. Pupin, the president, occupied the chair.

Mr. Frank E. Knight read a paper on "The Influence of Electric Railroads on Population and Land Values in Cities."

On behalf of Mr. John Dennis, Jr., the inventor of the fluorometer, Mr. W. J. Clarke described the operation of that instrument as a surgical adjunct of the X ray, and read a paper prepared by the inventor claiming that the instrument was the only one capable of exactly locating any foreign substance after the X ray had indicated its whereabouts.

Dr. Pupin was of the opinion that the necessity of the surgeon cutting in a "bee line" to the bullet or other foreign substance in one's body did not exist, and therefore doubted the importance of the invention. There were always veins and arteries, etc., to be avoided by the skilled surgeon.

After this paper, Mr. W. J. Clarke gave a practical demonstration of the Marconi system of wireless telegraphy by means of his own improved apparatus, and spoke at some length of the Marconi experiments and his own. The experiments were quite successful, the signals being transmitted across the room and easily heard by all. Quite an animated discussion followed and it developed that as yet no tests had been made with a view to selective signaling to several receivers. It was brought out that experiments with a system of telephones were being made, but the results were not yet ready for publication. Some amusement was created by the receiver clicking, as if it had received a message, while Mr. Mailloux was speaking, though the transmitter was idle.

The opinion was expressed that a house with a tin roof would interfere with the transmission of these messages.

A vote of thanks was tendered to the authors of the evening's interesting presentations.

The Annual Report of the American Bell Telephone Company.

At the annual meeting of the American Bell Telephone Company, which was held in Boston, March 29, the surviving members of the old board of directors were re-elected, and J. Malcolm Forbes and Thomas B. Bailey were chosen to succeed William H. Forbes and Gardner G. Hubbard, deceased during the past year.

President Hudson, in his address to the stockholders, said :

"The output of the telephones and the increase in the number of exchange subscribers are unprecedented in the history of the business. The gain of exchange stations reported for the past two years equals the aggregate gain of the six years which preceded. The underground wire system is now in use in 130 of the exchanges, and 282,634 miles of exchange wire, or nearly 50 per cent of the total mileage of the United States, are now carried on by means of underground conduits.

"The limitations of the use of underground lines as regards distances are quite obvious. It has been found that, with the best class of cables built for the purpose, transmission can be accomplished by this means for distances of only a few miles. So far, therefore, as the development of the art has gone, it is still impracticable to employ underground lines for what is known as toll or long-distance service.

"During the year the long-distance company's lines have been extended to reach Omaha in the West, Minneapolis to the North, and southerly to Petersburg and Norfolk. There were in operation on January 1. 1898, 8,778 miles of pole line and cable, and 116,116 miles of wire, connecting 238 offices, a gain during the year of 1,433 miles of pole line and cable, 8,706 miles of wire and 55 offices.

"The number of exchange stations operated under the licenses of this company is 384,230. This equals, within a few thousand, the aggregate number of exchange stations in all of continental Europe. Next to our own country comes the German Empire, with 122,332 exchange stations (1896), and next Great Britain, with 85,316. In the United States conversation is now had by subscribers over distances of 1,800 miles, which is twice the length of line anywhere else employed for telephonic use.

"The new construction completed in 1897 by companies with which we have contract relations amounted to $8,712,914. Of this sum $4,865,317 was expended upon exchange construction and equipment, and $3,847,596 upon toll lines. In addition to the above, $1,484,332 was invested in real estate to be used for company and exchange purposes.

"The entire expenditure for construction, including real estate, to the close of 1897, has been $97,946,102.

"The long-distance company had invested up to December 31, 1897, in line construction, franchises, equipment and supplies, $13,888,752. The company shows an increase in gross earnings in 1897 over 1896 of 16 1/10 per cent, the amount for 1897, gross, being $1,879,294."

Treasurer W. R. Driver, who was unanimously re-elected, submitted the following ledger balances for December 31, 1897 :

DEBTORS.

Telephones	$1,772 596 55
Real estate	1,052.695 92
Stocks and bonds	52,827,205 59
Merchandise and machinery	18,319 68
Bills and accounts receivable	3,275,059 70
Cash and deposits	1,833,964 11
	$60,779,841 55

CREDITORS.

Capital stock	$25,886,300 00
" " premium account	6,110,582 00
Debenture bonds, 1888	2 000,000 00
Bills and accounts payable*	1,216,330 89
Patent account (profit and loss)	12,399,047 16
Profit and loss	6,551,451 94
Reserve	4,025,628 29
Surplus	2,590,521 27
	$60,779,841 55

WILLIAM R. DRIVER, Treasurer.

Boston, March 29, 1898.

*Of this amount $1,164,833.50 is for the dividends payable January 15, 1898, to stockholders of record December 31, 1897.

The following comparative statement of earnings and expenses was also submitted :

EARNINGS.

	1896.	1897.
Rental of instruments	$1,238,378 08	$1,597,959 36
Dividends	2,616,307 00	3,085 379 00
Commission from extra territorial lines	182,265 32	211,507 21
Commission from telegraph business	34,046 88	33,174 32
Real estate	50,864 38	84,709 85
Interest	171,355 23	117,071 93
Miscellaneous	4,107 41	1,043 25
	$4,327,324 25	$5,130,844 92

EXPENSES.

Expenses of operation	$499.052 31	$509,314 02
Legal expenses	100.744 78	136.333 49
Real estate	40,117 87	41,560 76
Interest and taxes	303,731 38	273 961 92
Miscellaneous	97 47	
	$943.743 81	$961.170 19
Net earnings	$3,383,580 44	$4,169.674 73
Surplus account December 31, 1896	$2,151,011 61	
Net earnings, 1897	4,169.674 73	$6,320,686 34
Regular dividends, 1897	$2,939.904 00	
Extra dividends, 1897	743,044 50	
Reserve for depreciation of insts	47,216 57	
		3,730,165 07
Surplus account December 31, 1897		$2,590.521 27

The American Telephone and Telegraph Company (long-distance) files the following statement with the commissioner of corporations, Boston, February 28, 1898 :

ASSETS.

Real estate	$83.637
Cash debts receivable	1,180,710
Equipment, etc.	13,865.665
Miscellaneous	8,554,985
Total	$23,684,998

LIABILITIES.

Capital stock	$20.000,000
Debts	2,223,203
Reserves	522,053
Profit and loss	939,742
Total	$23,684,998

The Electrolytic Marine Salts Company, of Boston, Mass., and North Lubec, Me., claim to be recovering gold from sea water at a profit. "The secret process" by means of which this Klondike is operated consists in mingling a flow of sea water with chemicals and treating it electrically. Then the descriptive circular goes on to tell how stock in the company may be secured. Why do such concerns always select a New England town for their financial operations? We thought Pennock, the primary battery man, had worked that territory to the limit.

CENTRAL POWER PLANT ON BOARD SHIP VERSUS DISTRIBUTION OF POWER.

READ BEFORE THE AMERICAN SOCIETY OF NAVAL ENGINEERS BY PROF. WM. S. ALDRICH.

There are certain inherent advantages in centralizing the generation of power for any given purpose. In almost all cases the original sources of power for the purposes under consideration are the steam engine and boiler plants. In all cases of the use of steam it has been long known, and practiced as well in its generation as in its utilization, that greater economy is to be effected by a centrally located plant. However, when it relates to the transmission and distribution of power from such central steam plant, we are at once confronted with the claims of three principal rivals; namely, compressed air, water pressure, electricity. In particular, on board ship we believe there will be reduced cost of installation, increased economy of operation, fewer men required in operation and management, if all the power required for the several auxiliaries should be developed in a single power plant. The same principle has been fully worked out in the mechanical equipment of modern office buildings, hospitals and other public institutions, department stores and isolated plants.

Only one working fluid is actually required for all cases of power distribution. If we are permitted for a moment to speak of electricity after the manner of the old school and to consider it as a working fluid, then it is quite clear that all of the auxiliary machinery on board a naval vessel may be operated by any one of the working fluids—steam direct from the boilers, compressed air, water pressure or electricity. Moreover, only one working fluid is actually required.

All the various operations now carried on by so-called "mixed systems" of power distribution on board ship can be effectively reproduced and satisfactorily performed by suitable motors and mechanisms driven by any one of the working fluids above noted. Primarily, of course, all power for such distribution is to be derived from steam engines. Therefore the efficiencies of transformation of energy in each of the above cases should not be left out of consideration. It is not our present purpose to enter the discussion respecting such efficiencies of transformation involved in converting steam-power into compressed air, water pressure or electricity.

For all the purposes, therefore, for which power may be required on board ship it may be developed:

1. In a centrally located plant. This should, of course, be as near the battery of boilers and main engines as possible, placed in the same or adjoining water-tight compartments, and all below the protective deck.

2. At points where the power is to be utilized. In this case several power-generating plants require to be located in different parts of the ship, being most suitably installed at or near the centers of distribution. In this case, however, it must be remembered that steam from the boilers is the original source of energy for the distributive development of power. All prime movers for any system of power generation on board ship are, and will continue for a while to be, of the various types of simple and compound steam engines.

(To be concluded.)

The Philadelphia Electrical Exposition.

The Philadelphia Electrical Exposition Company will give an electrical exhibition in its building, 818 and 820 Chestnut street, Philadelphia, beginning June 6, 1898, and continuing for one month.

The exhibition building is in the heart of the city, is a large and commodious structure fronting on Chestnut street, the principal retail thoroughfare, and at least 150,000 people pass the doors daily.

Various novelties of an electrical character will add to the general attraction of the exhibition, and it is said to be the intention of many of the prominent exhibitors at the New York exhibition to be held in May, to send their exhibits to the Philadelphia exhibition. Especial attention will be given to recent electrical inventions, and to the exhibits of distinguished inventors, when of an attractive character. Prof. Wm. D. Marks is the director of the exposition.

Edison Manufacturing Company's New Store.

Mr. Thomas A. Edison, proprietor of the Edison Manufacturing Company, has leased the entire corner store and basement of the St. James Building, Broadway and Twenty-sixth street, New York city, these premises having a total area of upwards of 8,000 square feet.

These premises are to be used as show-rooms, in which many of Mr. Edison's inventions will be on exhibition, including the new Edison phonographs, the Edison projectoscope, the Edison X-ray apparatus, electro-cautery transformers, combination adaptors for medical work, electrical centrifuge for urinal analysis, fan motors for battery and 110-volt direct current and the Edison–Lalande batteries. The new store was opened to the public last Saturday evening.

SPEED GOVERNMENT IN WATER-POWER PLANTS.

READ BEFORE THE FRANKLIN INSTITUTE, PHILADELPHIA, DECEMBER 14, 1897, BY MARK A. REPLOGLE.

No problem in hydrodynamics has created so much interest in the past few years as the government of water-powers. When it had been demonstrated that power could be successfully transmitted to great distances by the use of electric currents, the economist very naturally conceived the idea of harnessing available waterfalls. It was well known that turbine water-wheels could be constructed that would furnish to a dynamo an efficiency of 75 per cent, or more, of the energy represented by the fall or head. The conservative engineer and the investor, however, were much concerned about the possibilities of regulation or government, and much diversity of opinion has been expressed by thoughtful and earnest engineers regarding it. Specialists have spent much labor in experimenting and developing apparatus to govern power plants. It has been demonstrated that water-power plants can be successfully governed. But the various degrees of regulation, ranging from indifferent speeds up to good engine practice, even with the same apparatus when used in different water-powers, prove that there are some underlying principles that must be adhered to if successful regulation is to be obtained by calculation or intelligent reasoning, and it is for the purpose of discussing some of these principles that this paper has been prepared.

Very little literature can be found that treats on the government of water-powers in a scientific manner, and what is extant shows that the German, Swiss and French engineers had spent much thought and labor on this subject years before the problem became an important one in America. Space forbids any comments on their experiments or practice, except to say that, until within a very few years, they were far in advance of our own hydraulic engineers in this particular part of power-plant construction.

Regarding the early work in this line, nothing better can be said than to quote the "Encyclopædia Britannica," which says: "The science of hydrodynamics was cultivated with less success among the ancients than any other branch of mechanical philosophy. If we except a few propositions on the pressure and equilibrium of liquids, hydrodynamics must be regarded as a modern science which owes its existence and improvement to those great men who adorned the seventeenth and eighteenth centuries." During the early part of the nineteenth century rapid advances were made by Europeans in methods of getting power from gravity by the use of the agent water. The interest awakened by the success attained, as well as the necessity of good government in localities where steam power was expensive, no doubt had much to do toward an early development of governing apparatus in the European countries. In America, steam-power has been so cheap as almost to supersede water-power in some localities, and where steady power was a necessity it was almost invariably furnished by steam engines, water-power being used only where little or no government was required. Hence the American manufacturer was fairly satisfied with a device that would slowly move his wheel-gates when too great a change was perceptible in the speed of his plant. Such device was called a governor until the electrical engineer of recent years discovered that his machinery was safer if he ignored entirely the so-called water-wheel governor.

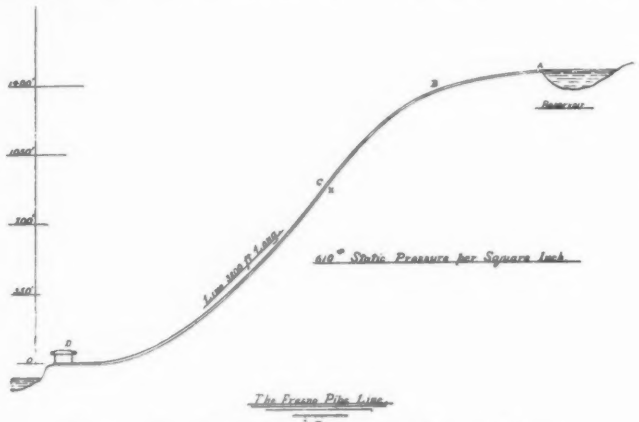


FIG. 1.—SPEED GOVERNMENT IN WATER-POWER PLANTS.

The late successes in long-distance transmission make water-powers more valuable than they have been considered in the past, and the demands for reliable speed regulation are so urgent that there is a decided tendency on the part of engineers and investors to study the proposition more from a scientific point of view, laying bare, if possible, the principles that underlie it. These principles, then, may be used for foundations from which to reason out a solution of the problem. The doubts concerning the satisfactory government of water-power have often caused capital to be withheld where it otherwise might be earning handsome dividends. It is very apparent that speed government in water-powers should be reduced to an exact science, if possible, and it is hoped that this paper will exert some bearing to that end.

The following preliminary view of the proposition will disclose some of the difficulties that do not appear at first thought: First to be considered is the water. It is an inert material, incompressible, and having inertia, hence momentum, when in motion. It contains no power whatever, except that generated by gravity in giving it motion. Perhaps no better demonstration of the evil effects of inertia and momentum in governing can be given than the experience at the power plant of the Fresno transmission. (Plate 1.)

A feeder pipe about 3,800 feet long is used to carry the water from A, the outlet of a reservoir on a mountain top, to D, the power-house on the San Joaquin River. The fall or head in this case is 1,410 feet, and the pipe is amply heavy for all the ordinary strains that come in the manipulation of the power. Before the plant was ready for actual operation, through some accident, a valve at D was opened, allowing a four-inch stream of water to escape; the pressure gauge, which ordinarily showed 610 pounds to the square inch, dropped to 350. The valve at D was almost immediately closed by the attendant when the pressure-gauge pointer ran up to its limit, 1,000 pounds to the square inch. Immediately following this was a great writhing in the pipe line, ending in a report at C about 700 feet vertically above the power-house. The pressure gauge dropped to about 300, and the flood of water coming down the mountain side indicated that the pipe had burst at C. Further investigation showed that the pipe from A to B had collapsed or flattened. The logical conclusion is, that when the valve was opened at D the portion of the water column from B to D began moving. That portion of the column from A to B lying in an almost horizontal plane did not have its inertia overcome quickly enough to follow, hence the column separated at B, causing a vacuum from B to C. When the valve at D was closed the water from D to C came to a standstill, raising the pressure by its momentum to 1,000 pounds per square inch, showing proof that the engineers had calculated correctly. By the time that the valve was closed at D the column A B had been acted upon by gravity for some seconds, thereby giving it time to acquire considerable velocity, hence momentum; therefore, when it reached the other column at C the concussion burst the pipe, showing at one bold stroke the effect of incompressibility and momentum. The collapse in the pipe from A to B was due of course to the water emptying faster at C than it could enter at A (the pipe line here being of much lighter steel).

It can readily be seen that if government in this plant were attempted by changing the flow in the pipe line, as is ordinarily done, it would have been an impossibility, if the safety of the installation was a consideration. Hence the governing is done by shifting a stream of water on or off the wheel as the power-demands require.

It might be added incidentally that the stream from a nozzle one and three-eighths inches in diameter furnishes about 500 horse-power, also that said stream can very quickly bore a hole through a granite rock or even a steel plate. It requires much care and ingenuity to handle this power plant, but it has been in actual operation for nearly two years, and is an unqualified success.

The inference to be drawn from the above experience is, that these evil effects appear in every power plant in a corresponding ratio to the length of pipes or closed flumes used to carry water to wheels. The injurious effect on government is to change momentarily the pressure or head on the wheel when any movement of the wheel gate is made. The effect is always the opposite from that required to keep even speed. Hence there is a limit to the time allowable in the gate movement.

The second factor to be considered is the water-wheel itself. It has a possible range of speed from zero to even faster than the spouting velocity due to the head, and it is unlike a steam engine in many respects. Its periphery must move at a velocity that is a proper ratio to the spouting velocity of the head, in order to gain the highest efficiency of power. The wheel also allows practically the same quantity of water to pass through it at any of its possible speeds. If any difference, it allows more water to pass through it at underspeed than it does at overspeed. So it can be readily seen that an accurate gauging of the water that enters the wheel does not necessarily have anything to do with the speed. The speed of wheel is the result of quantity of water combined with pressure on one hand and load of work on the other. Therefore, any change in one of these three factors causes a change in the speed.

If a wheel at the end of a long-closed pipe containing hundreds of tons of water were running at normal speed, carrying a certain load, its speed would remain constant if no changes were made in the conditions. If, however, the gates were slowly opened, its speed would be increased by the greater quantity of water entering it. If, instead of this, a part of the load were dropped off, the speed in like manner would rise. If the gates were slowly closed the speed would soon begin to fall. But if the gates were rapidly closed the momentum of this column would cause a much greater pressure at the wheel-

gate openings, and for an instant cause practically the same amount of water to enter the wheel at higher velocity. This amount of water having higher velocity will contain more energy or power for the time being, and of course will impart more to the wheel, increasing its speed slightly for a short time instead of immediately decreasing it, as would seem natural. This tendency for an increase in speed, added to the increase already caused by a part of the load being dropped, will make it necessary for a greater amount of work to be done by a governor than would be proper after the momentum effects in the pipe had subsided. It can also clearly be seen that, if the gates are opened again quickly, the velocity of the water entering the wheel will be decreased until the whole column acquires an increased motion; hence the power applied will be diminished for a time instead of increased. These momentary and opposite effects make water government a harder problem to solve than the government of steam.

Third, water-wheel gates, as compared with steam valves, are heavy and unwieldy. They must also be moved through water, which is much denser than steam, hence can not be moved with the same facility. They require much more power for their movement. Sometimes the designer of a water-power plant does not place importance enough on the government of the wheels to make substantial gate rigging. The gate shafts may be too light, showing torsion when operating, or there may be a train of cog gears that allows much lost motion. The gates may be so designed that the water pressure gives them an unbalanced condition, requiring much pressure to be neutralized before it is possible to move them in a reliable manner. Turbine wheel gates built in this country often weigh several thousand pounds each, and sometimes must be moved several feet through water in being opened. Often it is necessary to add weight equal to their own weight as a counterbalance. The power required to overcome the inertia of and move this great mass often reaches many thousands of foot-pounds. It can readily be seen that to govern such gates with precision and accuracy requires a combination of both delicate and powerful machinery. Also, when it is considered that it is possible to make the full change of an electric load in the fraction of a second and impossible for gravity to meet the power demands short of a number of seconds, it is plain that to govern a water-power plant successfully is a matter of more moment than would seem at long range. It must also be borne in mind that the change of load must occur and the speed must be impaired before it is possible for a governor to operate at all.

(To be continued.)

The Central Union Telephone Company is constructing a metallic circuit between Logansport and Monticello, Ind.

TELEPHONE NEWS AND COMMENT.

The Mexican Telephone and Telegraph Company has declared a regular quarterly dividend of two and one-half per cent, payable April 13.

The Keystone Telephone Company has about completed a deal with the Jeannette, Pa., Board of Trade, and a plant is to be located in that place. The town has raised $10,000 and will donate two acres of ground to the firm.

Mr. Thomas B. Doolittle, one of the pioneer telephone men, is a New York visitor for a few weeks and makes his headquarters at the Hotel Normandie. Mr. Doolittle early realized the importance of the telephone and has been a consistent worker in this interesting field since the year 1877, and therefore is "of voting age" as a telephone industrian.

Mayor Patterson has signed an amended ordinance permitting the Pennsylvania Telephone Company to bury its wires in conduits within the city of Harrisburg, Pa. It is stated that the company will begin work in a very few days and will lay conduits in alleys wherever possible and along the edge of the curbing. The conduits will radiate from the company's proposed new building, at Walnut street and Court alley.

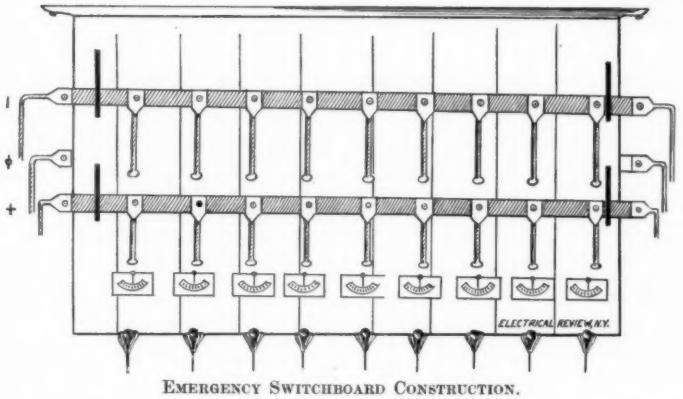
The Rocky Mountain Bell Telephone Company, with headquarters at Salt Lake, Utah, has let a contract for 4,000 telephone poles for the construction of a line between Missoula, Mont., and Mullan, Ida., which, when completed, about July 1 next, will give telephonic connection on the east from Livingston, Mont., to the Pacific coast. Wire has been contracted for, and the work on the connecting line will be begun in a month.

EMERGENCY SWITCHBOARD CONSTRUCTION.

BY GEORGE H. DRAPER.

Hasty temporary switchboard and regulating-room construction for a large central station has probably never been equaled, as was evidenced at the plant of the local electric lighting station at Washington, D. C., a few months ago.

One Friday morning, at 2 o'clock A. M., the entire switchboard and the regulating-room of the United States Electric Lighting Company, at the above-named city, was completely wiped out by fire, and on the following Monday the station was again in practical operation. As the superintendent of this station put it, "the entire lighting station's heart was out." All electric lighting of the city was out with the exception of a few arc lamps, and every cable connection from the station to the street mains was burned away, as well as the rheostats and instruments, etc. This condition demanded heroic action. Mr. Frederick Sargent, the electrical engineer, under whose supervision the United States Electric Company's new station is being constructed, happened to arrive in town on the evening previous to the fire. He was immediately sent for, and before the fire was entirely subdued had under way the new temporary switchboard.



EMERGENCY SWITCHBOARD CONSTRUCTION.

First, hasty plans were sketched. Large three by one-inch copper rods for bus-bars were telegraphed for, but before their arrival some 50 or more feet of heavy copper bar was discovered in the loft of the station. It was so old that at first glance it looked like iron that had rusted, but Mr. Sargent, happening to scratch a portion of it with his pocket-knife, discovered the godsend.

A wooden frame constructed of ordinary pine, about 10 feet high by 22 feet long, was erected in a room made by tearing out the partition between the old station office and the dynamo winding-room and toilet-room. The bus-bars were placed on the frame and held in position by home-made wooden brackets; the positive and negative bars being on the front of the board while the neutral was placed upon the back. Some large cable was at hand which had been purchased for additional feeders. This was cut up in proper lengths and spliced to the burned ends of the mains coming into the station. Small wire from all the construction firms in town was purchased, as was a great amount from Baltimore.

Rheostats, instruments, switches, etc., were sent for, but these did not arrive before the latter part of the week. Field wires were run and half-burned rheostats were used as far as possible; cable ends spliced, lugs soldered on and the cables were bolted direct to the bus-rods without switches or fuses, and only in two or three cases were ammeters used.

The greatest difficulty was found in making the connections. The work of splicing cables was done so hurriedly, and many of them by inexperienced hands, that this led to the mixing up of the cables. The result was the feeders lost their identity. The employés and extra hands were worked night and day, and were so tired out that testing was done somewhat carelessly. Nothwithstanding all of these difficulties, on Sunday the dynamos were started and the system put into operation. It had not been running long before a very heavy ground was discovered. Attempts were made to burn it off, but it was found impossible. Testing each feeder was again resorted to and the result was that in making the hasty connections to the bus-rods the positives and negatives of number one and number six feeders were inverted, and these two main feeders were working against the others. This remedied, and the system was in full operation. To be sure the voltage was high and could not be regulated with the few instruments at hand. The lights were brilliant for several days, to the great satisfaction of customers until they received their bills.

Herewith is a diagram of this temporary pine-wood switchboard, from which was operated, without switches or fuses or one-half the complement of rheostats and instruments, the entire system of a large central lighting station.

Electrically Controlled Torpedoes.

TO THE EDITOR OF ELECTRICAL REVIEW:

In your issue of March 23, page 184, you say: Engineer officers of the army and torpedo experts of the navy are said to be experimenting with a new form of automobile submarine torpedo.

Allow me respectfully to inform you, in the year 1882 I assisted the late Anthony Reckenzaun to construct a torpedo; it was operated by an electric motor, current for which was supplied from shore through wires trailing after the torpedo.

Yours truly,

HY. ALBERT.

Gainesville, Fla., March 26.

Electrical Review

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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The interesting series of articles, entitled "Told In The Dynamo-Room," which have been appearing biweekly in the ELECTRICAL REVIEW, have attracted a great deal of attention and favorable comment from those in the electrical field whom they were designed to instruct and entertain. The article due to appear this week has, we regret, been crowded out. The series will continue during the year.

ELECTRICITY IN MODERN WARFARE.

It has come to be pretty well understood, even by the layman, that many of the fine points of modern warfare, both on land and sea, depend for their ultimate success in practice on the electric current in one form or another. This fact is brought to mind with vividness in the preparations which have been making for the past few weeks by the United States for a possible conflict with Spain. The daily press has kept the public informed of the tremendous emergency preparations outlined and accomplished by the engineer corps of both arms of the service, which have resulted in placing the country practically on a war footing.

Leaving aside the technical militarism of the subject, it will be interesting to glance hastily at the part played in these preparations by electrical engineers and manufacturers. In the first place the government during the past two weeks has purchased thousands of miles of submarine and underground cable and other kinds of wire. These conductors will be used for connecting and operating submarine mines and torpedoes, for establishing means of communication between the coast defense fortifications, and for feeders to supply current to the searchlights located at advantageous points along the coast. Nearly all the large wire manufacturing companies are working their plants day and night, and the orders of many of their regular customers have been side-tracked on the patriotic understanding that the government's needs at such a time must take precedence. One wire company has been ordered to manufacture all the cable of a certain type it can turn out by a specified date some months in the future. It is probable that such an order has never before been placed.

Possibly the most important electrical apparatus required by the engineer corps having in charge the coast defenses is the searchlight. Our navy is pretty thoroughly equipped with these valuable devices, although a considerable number have been required for the craft recently purchased by the Navy Department and rapidly transformed into picket and dispatch boats. The searchlight is regarded as the best, and sometimes the only defense against torpedo-boat attacks. It is also highly esteemed as a means of signaling at night, and a battle-ship equipped with two searchlights can signal on a modified wig-wag system with perfect success. The value of the searchlight on coast fortifications is of a similar character. By its use the approach of a torpedo-boat or other hostile craft, or the approach of a landing party, may be detected. There is said to be but one manufacturing plant in the United States where searchlight mirror projectors can be made and it is understood that this plant is running night and day to accumulate a stock of its product. The electrical companies manufacturing searchlights have also received large orders. In this connection, it is interesting to note that central stations located near the Long Island coast, such as the Edison Company in Brooklyn, have arranged to supply all the current required to operate searchlights on the fortifications in their vicinity.

Electricians familiar with setting and connecting submarine mines have been in great demand. The army engineer officer in charge of the fortifications in the vicinity of New Orleans has made a request for as many experts as can be spared. The General Electric Company has furnished a party of 20 experts, which will be placed at the service of the government for torpedo work and connecting up searchlights. The Western Union and the Postal Telegraph companies have formed two corps of expert telegraphers composed of 50 men each, equipped with pocket kits of tools. These, it is understood, have also been placed at the service of the government. The submarine cable between Key West and Dry Tortugas has been finished and is now in use.

Capt. Robert McCulloch, of St. Louis, has tendered the services of the confederate veteran camp, of which he is the commander. A Milwaukee electrician has perfected plans for apparatus, by means of which the X rays may be available for use on war vessels and in the field for the assistance of the surgeons who will have the care of the wounded. The well known ease with which a bullet or a splinter in a man's body may be located by the X rays will render their use of great benefit.

In the meantime the telephone companies along the coast have been making plans to assist the government in any way they can, and the Chicago Telephone Company has arranged to notify every one of its 18,000 subscribers within 20 minutes after the official declaration of war has been issued. What goes before is only a part of the important work the electrical industry and its engineers have performed in the preparations for defense. There are many other schemes wh ch have been carried out that can not be made public, and all concerned are on the *qui vive* waiting for the word.

It is well that President McKinley is a man of physical strength. Never in the history of this country, since the days of Lincoln, has it been so important that the President should possess "a sound mind in a sound body." Few can realize the strain, mental and physical, to which the duties of the past few weeks have subjected him. What a serious thing it would have been had Mr. McKinley broken down! But no; wisely he observes the laws of health and is bearing up under the tremendous pressure in a way that is the pride of every American and the astonishment of every other nation in the world.

The annual report of the American Bell Telephone Company shows a very satisfactory increase in the business of the company. Since its organization in May, 1880, succeeding to the business of the National Bell Telephone Company, a wonderful growth is evident. In 1880 there were 28,316 miles of wire and 132,692 telephones in use, and the dividends paid amounted to $178,500. Less than 18 years later, at the end of 1897, the Bell company controls 626,400 miles of wire, 919,121 telephones, and paid during 1897 dividends of $3,682,948, with a capital stock of $25,886,300.

Wall Street and the Electrical Stock Market.

The week in the stock market opened with a demonstration against the bears which will long be remembered. The short interest, which was very large, was badly "squeezed," and prices advanced 5 or 10 points almost in as many minutes. It was the short interest bidding up prices on itself rather than really good buying which was responsible for Monday's skyrocket jump in values. During the balance of the week there was fair buying of various stocks by a certain clique which was supposed to have advance information that the Spanish difficulty would be settled amicably. There was not much evidence that the strongest financial interests acquired very much stock during the week. For the most part the market was largely professional. On Friday the turn for the worse in the Spanish question, resulting from Sénor Sagasta's reply to the American representations, was the cause of both liquidation and short selling, with a resultant break in prices. Necessarily everything now hangs upon the action of Congress in the matter. The best opinion in the Street favors a sharp break on the declaration of war, immediately after which will come a sharp rally caused by heavy buying from shrewd investors and strong institutions which have been waiting for precisely such an opportunity to acquire good stocks and bonds at low figures.

General Electric was fairly active on Monday, 6,400 shares changing hands and the price touching 34. It sold at 34¼ on Wednesday and declined to 31¾ on Friday. The company this week filed a statement of its condition on January 1 (its fiscal year ends January 31) with the Massachusetts Commissioner of Corporations, which shows that its assets were as follows: Real estate, $659,113; cash and debts receivable, $6,560,727; goods on hand and in process of manufacture, $3,896,872; patent rights, $8,000,000; debentures in the treasury, $2,000,000; miscellaneous securities, $10,774,398; balance (deficit), $11,308,111; total, $43,199,223. This compares with a total of $47,607,428 for 1896. The difference is due to the decrease of about $3,600,000 in cash and debts receivable, of $1,000,000 in miscellaneous securities and about $1,300,000 in the balance (deficit) in 1897 over 1896. The debentures in the treasury increased nearly $1,500,000. The liabilities on January 1 last were: Capital stock, $34,712,000 against the same in 1896, and debts and reserve, $8,487,223 against $12,895,448 in 1896.

Western Union sold up to 88½ on Monday, declining during the week to 84 at the close. The stock was quiet throughout. The collateral trust 5's sold at 109.

North American was dull and absolutely featureless, the quotation ranging from 5 to 5¾.

Of American Telegraph and Cable less than 100 shares changed hands during the week, at 88 to 89. Edison Electric of New York stock sold at 120 to 124, the 1st 5's at 109 and the consolidated 5's at 114½.

The instrument statement of the American Bell Telephone Company for the month ended March 20 shows gross output of 28,909; returned, 15,437; net output, 13,172. Since December 20 the gross output aggregated 80,667 instruments, and net, 42,099, making the total outstanding March 20, 961,220, an increase over the corresponding period in 1897 of 164,973.

The following dividends were declared during the week: Boston Electric light, quarterly, $1.50, payable April 15; Central & South American Telegraph, quarterly, 1½ per cent, payable April 6; New York & Pennsylvania Telephone and Telegraph, 1½ per cent, payable April 15; Pennsylvania Heat, Light and Power common stock, 50 cents, and preferred stock, $1.55, both payable April 15.

On the Boston Exchange, Bell Telephone, on sales of less than 800 shares, rose from 240 last Saturday to 255 on Wednesday, closing at 247 ex-dividend; Erie Telephone gained 4⅛ points to 64⅛ on Friday; General Electric preferred, after advancing 2½ to 34, declined to 32¾, back to 34, reacting on Friday to 32. A small amount of New England Telephone changed hands at 125 @ 125¾. The latter company on Thursday filed a certificate with the Commissioner of Corporations of Massachusetts, announcing an increase in its capital stock of $1,021,100, all paid in.

Transactions in electrical stocks on the Philadelphia Exchange were barely nominal, Electric Storage Battery common selling within a range of 1⅜ points, from 21 to 19⅝, while one sale of the preferred was noted at 23¾. Pennsylvania Heat, Light and Power was not traded in.

Wall Street, April 2. RAY.

The Electrical Engineer Institute of Correspondence Instruction.

As announced elsewhere in this issue of the ELECTRICAL REVIEW our esteemed contemporary, the *Electrical Engineer*, has established a correspondence institution for instruction in electrical engineering. The methods of instruction and the requirements for joining classes are fully set forth in a pamphlet to be had free on application. Our contemporary has the experience and the facilities which should insure the success of its new venture, to which we accord a hearty welcome.

Legal Matters.

The Western Telephone Construction Company, of Chicago, inform the ELECTRICAL REVIEW that the Firman patent, recently in litigation, does not, in any matter whatsoever, affect the multiple transfer system of the switchboard of their company.

A bill of complaint has been filed in the United States Circuit Court at Chicago by the Western Telephone Construction Company against the American Electric Telephone Company asking that the defendants be restrained from infringing on a patented appliance which is used in a telephone switchboard.

Suit has been brought by the Thomson-Houston Electric Company against the Wagner Electric Manufacturing Company under the self-starting alternating-current motor patent No. 430,328, dated June 17, 1890. The bill alleges infringement of this patent and asks for injunction and damages. It is understood that the patent is directed against the Wagner self-starting single-phase power motor.

General Electric Finances.

The Boston *News Bureau* announces that the General Electric Company has since January 1 canceled and burned $2,000,000 more of its debenture bonds, leaving the amount now outstanding slightly under $6,000,000, and that a plan is now being perfected under which the capital impairment and the accumulated dividends on the preferred stock will be equitably dealt with. Many plans have been suggested during the past two years, but there were legal objections to every one except the one which is now under consideration. Following the adoption of this plan General Electric common will be placed upon a dividend basis. It is possible that one share of new common stock will be given for two shares of present General Electric stock, and that six per cent dividends will be paid upon the new common stock.

OBITUARY.

Edwin Knowles, 20 years old, died at his home in Brooklyn, N. Y., on April 3, as the result of injuries received in a bicycle accident. He was a son of Mr. E. R. Knowles, a well known electrical engineer.

At the meeting of the New York Electrical Society, held on March 30, 51 members were elected.

PERSONAL.

Prof. Alexander Graham Bell has been elected to the presidency of the National Geographic Society.

Mr. E. Cate, of the L. E. Knott Apparatus Company, of Boston, is spending a few days in the metropolis.

Dr. Ph. Lenard, assistant professor of physics in the University of Heidelberg, has been called to the chair of physics at KIEL.

It is planned to secure a portrait of Lord Kelvin for the rooms of the Royal Society. Lord Kelvin was president of the Royal Society from 1890 to 1895.

Mr. Charles W. McDaniel, superintendent of the Missouri & Kansas Telephone Company, Kansas City, Mo., was an eastern visitor last week and paid the ELECTRICAL REVIEW a welcome visit. Telephone interests in the West, Mr. McDaniel reports, are extending constantly.

Col. F. C. Mason, superintendent of the Brooklyn, N. Y., Police Telegraph Bureau, has tendered his services to Gen. Wesley Merritt in case war is declared against Spain. Colonel Mason is an expert Morse operator, and will undoubtedly render valuable aid to the government if occasion demands.

Mr. H. C. Dodge, who has been identified with various telephone interests for many years, and who during the past year held the position of general manager of the American Electric Telephone Company, has severed his connection with that concern and accepted a similar position with the Western Telephone Construction Company. President Keelyn is to be congratulated on securing the services of the gentleman named, and Mr. Dodge, in his new field, will no doubt find ample scope for his ability in the telephone line.

Mr. A. A. Carey, for many years with the Abendroth & Root Boiler Company, has accepted the position of manager of the Monarch Manufacturing Company and has opened offices at 39 Cortlandt street, New York. Mr. Carey is an able and experienced engineer of wide acquaintance and his connection with the progressive Monarch Manufacturing Company can not fail to prove of mutual advantage. The ELECTRICAL REVIEW extends its congratulations to both parties over this alliance. The success of the engine-stop and speed-limit apparatus of the Monarch company has been phenomenal, and under Mr. Carey's intelligent and energetic work it is certain to gain increased patronage and usefulness.

INSULATION AND CONDUCTION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, MARCH 23, 1898, BY REGINALD A. FESSENDEN.

(*Continued from page 197.*)

This phenomenon is not known to take place in solids, but it is quite marked in gases, vapors and fluids.

Until recently it was a question of no practical importance in electrical engineering, but with the high voltages now in use or contemplated it may give serious trouble, and apparatus must be designed to check this form of leakage. It was not so long ago that Ferranti's 10,000 volts was looked upon as monstrous, but some experiments of the large companies, of which I have been informed, seem to show that 100,000 volts may be quite practicable, even in quite unfavorable climates. With overhead wire the leakage will merely mean a loss of energy and the use of porcelain for all insulation, as any oxidizible material (used, for instance, to protect the primaries of transformers) would be speedily destroyed by the ozone. Where, however, oil is used in the transformers, the leakage may cause quite serious trouble, owing to the large surfaces and their proximity. In addition, as Prof. Elihu Thomson pointed out some years ago, with high potentials, impurities in the oil are apt to group themselves along the lines of highest slope of potential like the iron filings around a magnet, and if, as is generally the case, the impurities have a higher specific inductive capacity than the oil, such a group is thus apt to form a bridge between two points of great difference in potential, hence causing an arc. In those convection currents it is not, I believe, the very small particles which cause the trouble, because small bodies, when charged from a comparatively large and smooth one, are not repelled, but attracted; consequently, a small grain of dust after touching a highly charged flat conductor would remain close to it if there were no negatively charged particles near it to drag it away or no currents in the oil to wash it off.

The relation between the size of the particle, the voltage and the radius of the charged conductor when the particle after touching the conductor is neither attracted nor repelled, can be obtained by the method of images, but the formula so derived is rather long and complicated and I have not had time to work out the numerical results.

It is evident, however, from it, that for a convective current to take place the radius of the particles carrying the discharge must be a quite appreciable fraction of the radius of the charged conductor. Consequently this form of leakage is due to the motion of a portion of the oil as a whole and not of its individual particles, and if we can break up mechanically these currents we can to a great extent stop the leakage from this cause. This may be done in three ways:

1. By using oil of great viscosity, in which case, however, we lose the chief advantage of oil insulation; i. e., its ability to reinsulate quickly after a discharge.

2. By putting pure dry cellulose in some form or other between the charged surfaces loosely, so that the oil can filter through it easily and any air escape readily, but sufficiently close to prevent any rapid flow. Pure cellulose has the great advantage that when well boiled in the oil it has approximately the same specific conductive capacity as the oil. No varnish or shellac should be used in the oil for reasons given later.

3. By dissolving a solid, non-disassociating substance in the oil in such excess that it crystallizes out at ordinary temperatures and forms with the oil a soft gelatinous mass, not fluid, but yet capable of allowing the oil to ooze through its substance. This has many of the disadvantages of one, but it has one advantage, in that the substance chosen may be one, like paraffine, having a large specific heat of liquefaction, and consequently an overload will not raise the temperature of the oil above a fixed point till the paraffine is all melted.

The effect of points in promoting convective discharges in air is well known. It is usually attributed to the great surface density of electricity which a point must take in order to make the potential all over the conductor the same, and hence, since the repulsive force varies as the square of its surface density, it is evident that there will be a great tendency for discharge from a point from this cause. But there is another and very important one; i. e., the fact that, as mentioned above, a particle can not take a charge and move away unless its radius is larger than a certain fraction of the radius of the curvature of the conductor at the point where it touches the latter; consequently, when the charged surface is a plane, only large aggregations of atoms can move away; these move slowly and carry small charges in proportion to their mass. But at points where the radius of curvature is very small, small particles can move away with great rapidity and with relatively large charges. Rounding off or flattening the charged surfaces thus acts in a double way, by reducing the surface density and by preventing all but large sized particles moving away.

2. *Conduction in Solids*—It is not absolutely certain that all conduction is not by convection, but the terms are here used with their usual signification. In solids we do not know as yet exactly how the discharge is handed on, but I have noted a very remarkable fact, which is quite significant and suggestive; i. e., that the conductivities of metals are proportional to the quantity $\sqrt{\frac{\text{elasticity}}{\text{density}}} \div$ valency. The following table shows this.

TABLE OF CALCULATED AND OBSERVED RESISTIVITIES.

METAL.	ATOM. VOL.	ATOM. WT.	CALC.	R. CALC.	R. OBS'VD.
Silver.....	10.2	108	1	100	100
Copper.....	7.1	63.3	2	126	106
Gold.....	10.2	197	1	135	137
Aluminum..	10 5	27	3	152	159
Magnesium	14	24 4	4	220	275
Zinc.....	9.4	65.5	4	300	352
Cadmium...	13.	112.2	4	456	450
Tin.....	16 2	118	8	1030	878
Thallium...	17.3	204	6	1060	1190
Lead.....	18.2	207	8	1470	1305
Iron.....	7.2	56	4 or 8	480	646
Beryllium..	2	9	Unkn'n 50 or 100		....

This fact was discovered by the writer in 1892,* as the result of several years' tedious work in collecting physical data and combining them into formulas to see if any law could be found. Out of the hundreds of combinations tried, this and another one (really the same ultimately, but expressed in terms of other properties) were the only ones which seemed hopeful. It was stated in the article referred to that this formula could not be quite correct. This was for the following reason: Silver, gold and aluminum should, as will be seen from the formula given below, have resistances proportional to the square roots of their densities multiplied by their valencies; i. e., in the ratio of

$$\sqrt{10.6} : \sqrt{19.26} : \sqrt{2.65 \times 3}$$

i. e., 100 : 136 : 150.

Now at this time the best determinations of the resistance of aluminum with which I was acquainted gave it as 193 to silver 100. With such a wide discrepancy, therefore, between calculation and observation, i. e., 193 instead of 150, it did not seem probable that the high observed value could be modified by subsequent determinations so as to agree with the calculated one. It was, therefore, with considerable pleasure that I saw the recent determination of Messrs. Richards and Thomson published last year in the Journal of the Franklin Institute. Their results for aluminum, 99.66 pure, were:

Aluminum : Silver : : 163 : 100,

and they expressed the opinion that the value for pure aluminum, when hard-drawn, would be 66 per cent of the conductivity of copper. This result is so close to the calculated result given in the paper referred to—i. e.,

17 : 27 = 100 : 159,

though such a high conductivity for aluminum was considered beyond the bounds of probability at that time—that I feel justified in considering that the formula given may be found fairly accurate when more exact determinations shall have been made.

This formula throws a certain light on the nature of conductivity in solids, and why some solids are insulators. For the formula $\sqrt{\frac{\text{elasticity}}{\text{density}}}$ is the same as that for the velocity of sound in a body. Now, in the convective discharge, the electricity was handed on with the same velocity as that with which the particles moved. In fluids, as we shall see, the electricity is handed on with the velocity with which the ions move. In both cases the electricity travels along on the particles of matter.

(*To be continued.*)

*Science, July 22, 1892.

Paper Insulated Telephone Cables in Paris.

At a recent meeting of the Société Internationale des Electriciens, M. Barbarat described the new underground cables with air insulation employed by the Telephone Administration of Paris. These cables are insulated with paper, and the insulation is insured by injecting from time to time dry air under pressure. For this purpose the compressed air is supplied by the compressed air company; it passes over chloride of calcium, and is sent into each cable by means of taps. This dried air removes every trace of dampness and insures the insulation. Sometimes the operation can be facilitated by sending a workman to heat it on the spot. These cables have been tried over long telephonic systems and have given good results.

Engineering Endowments.

Miss Helen Gould last week gave $10,000 for the endowment of the New York University's engineering school. A year ago Miss Gould founded a scholarship for the engineering school, and the total scholarship general endowments available for the school of engineering contributed by Miss Gould amount to nearly $60,000.

Mr. William Houldsworth has given the University of Glasgow property yielding an income of £750 a year for a fellowship in physics. *Nature* states that Mr. Houldsworth has taken this method of showing his interest in the welfare of the University and the advancement of science and his recognition of the distinguished services rendered to scientific research by Lord Kelvin during a professorship of 50 years.

Mr. W. H. Baker, vice-president and general manager of the Postal Telegraph Company, returned last week after an absence of several weeks on the Pacific coast. Mr. Baker was able to combine a large amount of business with this trip of recreation, and returns well pleased with what he learned concerning the popularity and appreciation of the great telegraph system which he so ably manages.

ELECTRIC RAILWAY NOTES.

The new franchise for the Nevada, Mo., Electric Street Railway has been sold to C. N. Hammond & Company, of Kansas City.

Articles of incorporation have been filed in the Hudson County, N. J., clerk's office by the Alaska Railroad Company. The company will have an authorized capital of $1,000,000.

The stockholders of the Delaware, Ohio, Street Railway Company have offered the road to the citizens of the city for $37,500, its present indebtedness, and about one-half of its original cost.

The Asbury Park & Belmar, N. J., trolley road has been sold by order of the United States Circuit Court to Col. George B. M. Harvey, of Asbury Park, and Acton C. Hartshorne, of Freehold, for $53,000.

The Monmouth Traction Company, which is applying for the right of way through Burlington, Pa., has just completed a contract for lighting that city for $4,000 a year for five years, conditionally that they also build and operate the trolley system.

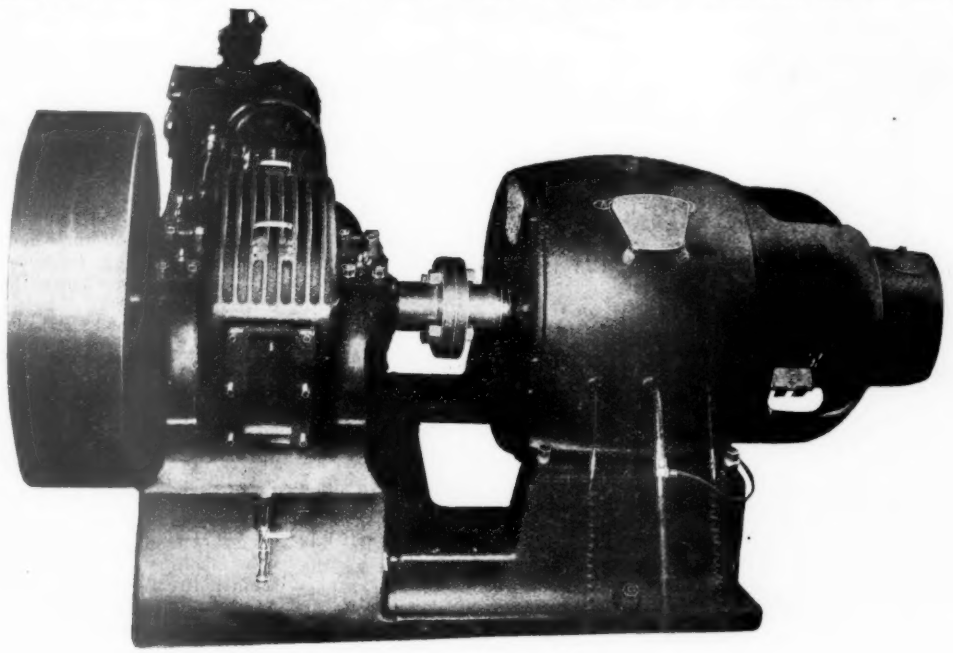
The Cincinnati Street Railway Company will issue $656,000 new stock, giving the stockholders the privilege of subscribing for the new issue at par. The allotment will be four per cent. The outstanding capital is $16,400,000 and the authorized capital is $18,000,000.

The Tiffin & Fostoria, Ohio, electric road, which was owned by Samuel B. Sneath, has been transferred to a company composed of Cleveland capitalists. The officers are D. H. Kimberly, of Cleveland, president; W. H. Gabriel, Cleveland, vice-president; C. O. Evarts, Cleveland, secretary; S. B. Sneath, Tiffin, treasurer.

The Chicago Electric Traction Company has taken possession of and is now operating the storage battery road formerly known as the Englewood & Chicago. The new company will issue $270,000 of first mortgage bonds, which will go to the holders of the old Englewood & Chicago bonds at par in proportion to their old holdings, and $900,000 (roundly) of consolidated mortgage bonds and $1,800,000 in common stock.

The Alameda, Oakland & Piedmont, Oakland, Cal., Consolidated and Central Avenue Electric lines, under the name of the Oakland Transit Company, has been incorporated. The capital stock is $5,000,000. The directors are F. M. Smith, E. A. Heron, F. C. Havens, W. H. Martin, D. D. Harris, J. C. Winans and Charles R. Bishop.

The Seoul, Corea, Electric Company has been organized in that city, with a capital of $300,000. This company, according to advices, has made a contract with Mr. H. Callbrau, of Denver, Colo, for the construction of the Seoul-Chemulpo Railroad, an electric trolley street line of the latest and most improved design. United States consul Horace N. Allen writes from Seoul that a cash payment of $100,000 with the above contract was given to Mr. Callbrau, and the work will be rapidly prosecuted. The consul adds that at present all the financial ventures of importance in Corea are in the hands of Americans.



A NEAT ISOLATED LIGHTING PLANT.

A Neat Isolated Lighting Plant.

The Wadsworth Salt Company have recently installed at their works, at Wadsworth, Ohio, a very neat and efficient lighting plant that is giving excellent satisfaction. The illustration herewith shows the generating unit composed of a 7 by 8 engine and a 15-kilowatt 125-volt D type dynamo, made by the Card Electric Company, of Mansfield, Ohio. The armature and engine shaft are coupled together by a flange coupling, which permits of quick and easy separation, and is a desirable feature when floor space is not of great moment.

The engine and dynamo-room is ample in size, nicely finished with a very handsome and convenient switchboard for manipulating the current about the works. The engine and dynamo were first put together at Wadsworth without a hitch, and, when ready, made a run of 16 hours without a stop, hot box or trouble of any kind. The company are well pleased with their plant, and already contemplate an extension.

The electric light plant of the Carbon County Improvement Company, at Weissport, Pa., was sold at a sheriff's sale for $50,000 a few days ago.

Development in Static Generators.

The relation existing between necessity and invention is nowhere more forcibly illustrated than in comparing the old-time glass-plate friction machine with the modern rubber-plate static generator. For years the friction machine was considered the best possible arrangement for generating static electricity. Later the induction machine of Holtz surprised scientists by the marvelous power of accumulation. Real improvements on this type of machine were slow, slight modification only appearing from time to time, as illustrated in the Voss and Wimshurst machine.

The necessity for a powerful, practical X-ray generator, realized only during the past two years, has been productive of vast and radical changes. Scientists of 50, or even 10, years ago would hardly believe in the reality of the modern high-speed static machine. Increased power and decreasing size seemed to have been the objective points. The success of the work is well illustrated in the latest machine offered by the L. E. Knott Apparatus Company, of Boston. Mounted in a glass mahogany case, it makes an attractive office instrument and serves equally well for an X-ray and electrotherapeutic generator. The new circular recently issued gives more detailed accounts of this machine.

Northwestern Electric Association.

At the Milwaukee meeting of this association a magnificent painting of the steamer "North-West" stood in the hotel rotunda, with a simple card attached bearing the inquiry "Why not?" To-day the same painting can be seen in Col. J. M. Hill's private office, Chicago. The card has a mate saying "It's a go!" and so it is. The splendid steamer has been secured and Colonel Hill is now in Buffalo meeting Vice-President Farrington, of the steamship company, and completing details of the trip. Now that the matter is definitely settled there is a unanimous desire on all sides to make the trip a complete success and great confidence is expressed that it will be. The gathering of a large number of technical experts, electrical and mechanical engineers and manufacturers will give the members one of the best opportunities for an interchange of ideas.

At the annual meeting of the Edison Electric Illuminating Company of Altoona, Pa., the following directors were elected: Messrs. S. H. Smith, A. J. Anderson, H. E. Ferguson, John Lloyd, H. C. Dern and C. A. Wood. Immediately afterwards the directors organized by electing H. C. Dern, president; S. H. Smith, vice-president; A. J. Anderson, secretary; Henry Cryder, treasurer, and H. E. Ferguson and C. A. Wood, auditors.

General Electric Company Extends Its Plant.

The General Electric Company on March 25 placed contracts for the construction at its Schenectady, N.Y., works, of a new foundry which will be one of the largest in this country. The building will be of brick, 500 feet long and 140 feet wide, with an "L" 100 feet by 120 feet. The latter will be used as a cleaning shop. Besides these main buildings a number of sand sheds, several smaller buildings for the storage of foundry material, and a new pattern storehouse 200 feet long, 60 feet wide and two stories high, will also be erected. All combined, the floor space occupied will be about 12,000 square feet. Plans are also under consideration for a new machine shop, 650 feet long by 165 feet wide, but the appropriation for this has not yet been authorized.

The buildings will be erected several hundred feet from the canal, and will have in close proximity the sand sheds and pattern storehouse. Every precaution will be taken to eliminate risk from fire; indeed, the pattern storehouse will be made as absolutely fireproof as possible. The foundry as laid out will be a model of the most approved modern practice.

The contemplated machine shop will be built on Central avenue opposite building No. 15, and will be devoted almost entirely to very large machine work. The size of the great generators which the General Electric Company has been manufacturing has of late been increasing until, today, a generator of 4,000 horse-power is not now regarded as of unusual size. In fact, generators of 5,000 horse-power are now in course of design, and the demand upon the shop in which the large machinery has heretofore been built has far outgrown its present proportions.

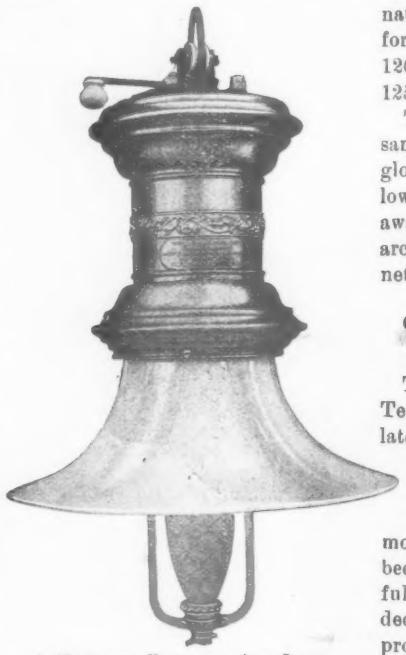
The middle aisle of the new machine shop will be 65 feet wide, with narrower aisles down each side. Electric traveling cranes will be installed to operate along each aisle, and a gallery will be built along one side only. All the large machine tools will be removed from their present locations to the new shop, their places being taken by smaller apparatus. The total floor space of this building will amount to not less than 144,250 square feet.

A New Cable Steamer.

There is now building in England a cable-laying steamer with a carrying capacity of 6,000 tons of cable. This is twice the capacity of any cable steamer now in service.

A Modified Enclosed Arc Lamp.

A modification of its enclosed arc lamp has recently been perfected by the General Electric Company, which, while preserving the essential features of its well known direct and alternating-current lamps, with enclosed arcs, substitutes a flared porcelain reflector for the outer globe. The mechanism of the lamp is similar to that of the standard enclosed arc lamps, but the use of the reflector, instead of the globe, allows a large amount of light, which otherwise would be absorbed in the outer globe,



A MODIFIED ENCLOSED ARC LAMP.

to be thrown down by the reflector and thus utilized. Calculating this absorption of light at from 10 to 30 per cent, the single-globe lamp allows the utilization of just so much of the total light from the arc, as well as that which is reflected. In cases in which the direct light from the arc is not objectionable and a general diffusion of the light not absolutely desirable, such as in cafes, hotels, restaurants, etc., the single globe is peculiarly adapted.

In designing the lower part of the frame, care has been taken to render it both light and delicate, and yet sufficiently rigid to withstand ordinary usage, without interfering to any extent with the passage of the light or casting heavy shadows. It is highly nickeled and thus during the day-time, when the light is not needed, the ornamental appearance of the lamp is not detracted from. The inside of the porcelain shade is highly polished and gives a good reflecting surface. It is interchangeable, and can be used with either direct or alternating-current enclosed arc lamps. By an arrangement of the lower rim of the cover of the mechanism, the reflector may be substituted for the outer globe of the double-enclosed arc lamps. As in the direct-current double lamps, a simple adjusting coil allows of the use of five, four and one-half, or four amperes. By using a reflector instead of the globe a very satisfactory light may be obtained from this lamp with a current of only four amperes. A reactive coil in the alternating lamps, allows of adjustment for any line voltage between 100 and 120 volts and frequencies of 60 and 125 cycles.

The economy in carbons is the same as that obtained in the double-globe lamps, and in addition the lowering of an outer globe is done away with. The globe in which the arc is enclosed is protected by wire netting.

Consolidation of Two Correspondence Schools.

The Correspondence School of Technology, of Cleveland, Ohio, has lately been incorporated with the Institute for Home Study of Engineering, also of Cleveland. The schools were started in 1894, almost simultaneously, and have since been carrying on their work successfully. In January of this year it was decided to consolidate them, the proprietors believing that still better results could be secured from a union of forces. Prof. E. P. Roberts, of the Correspondence School of Technology, is technical director; F. D. Leslie, business director, and J. H. Norton, secretary and treasurer of the Institute under the new management. The two latter gentlemen have been connected with the Institute for Home Study of Engineering from its inception.

These schools are said to have been the first to give electrical courses by correspondence. The new catalogue of the school announces a step in the direction of throwing off the character of privacy and entering the field of public institutions. The school is now partially under the control of an advisory board, not financially interested, and is so constituted that only a very moderate dividend can be declared to stockholders out of the earnings, the remainder being used for extension and improvement of the school's facilities.

The Monocyclic System in a Direct-Current Generating Station.

An interesting example of the introduction of the monocyclic system into a direct-current station, allowing the area of its operation to take a wide extension, exists at Middletown, Ohio, where Mr. E. H McKnight, the president and general manager of the Middletown Electric Light and Power Company, has recently found it necessary to increase the monocyclic capacity of his plant to meet the increased call upon his station. In addition to the arc and incandescent lighting usual in towns of the size of Middletown, certain factories under progressive managers have adopted electricity in place of steam, and the motor load on the station already far exceeds the lighting load.

The station fronts on the Miami & Erie Canal, having the tracks of the M. & C. Railroad immediately behind it. It is 65 feet wide and 115 feet long. Steam is supplied from two Brownell & Company Dayton boilers to one 450-horse-power compound condensing Buckeye engine, and one 300-horse-power four valve Russell condensing engine. The generating plant consists of two General Electric 12-pole, 150-kilowatt, 1,040-volt, 600-revolution monocyclic generators excited by two one and one-half-kilowatt exciters; three 50-light Thomson – Houston series arc dynamos and one General Electric 100-horse-power, 500-volt direct-current generator, all driven from countershafting furnished with the necessary friction clutches. The 500-volt machine is used exclusively to furnish direct-current to several small motor plants throughout the city; the arc machines operate 112 city arc lamps.

The motor load on the monocyclic machines runs up to within a short limit of their capacity. The factory of the Miami Cycle and Manufacturing Company, a little over a mile away from the station, takes 240 horse-power when its motors are running at their rated capacity, and considerably in excess of this under usual working conditions. This company manufactures the well known Raycycle, and 1,200 of these wheels are built weekly, giving employment to 600 hands. The current is received in the factory in six 40-horse-power, one 20-horse power and two 10-horse-power transformers, reducing the pressure to 115 volts. The motor circuits run from the 40-horse-power transformers, the lighting circuits from the three of smaller capacity, and all the current is measured in a recording wattmeter connected on the primary circuit. The motor equipment consists in all of 10 General Electric induction motors—three of 20 horse-power in the machine shop, driving 88 machines; one of 10 horse-power in the drill and pattern-room, driving 29 machines;

another of 10 horse-power, driving the machinery in the frame department; three of 30 horse-power in the polishing-room, two for the polishers and one for the 48-inch exhaust fan; one of five horse-power, driving two plating dynamos in the plating-room, and another of similar capacity, operating a number of small machines in the assembling room as well as a three-ton elevator. The incandescent lights in the factory number 750, of which, during the rush season, almost all are lighted.

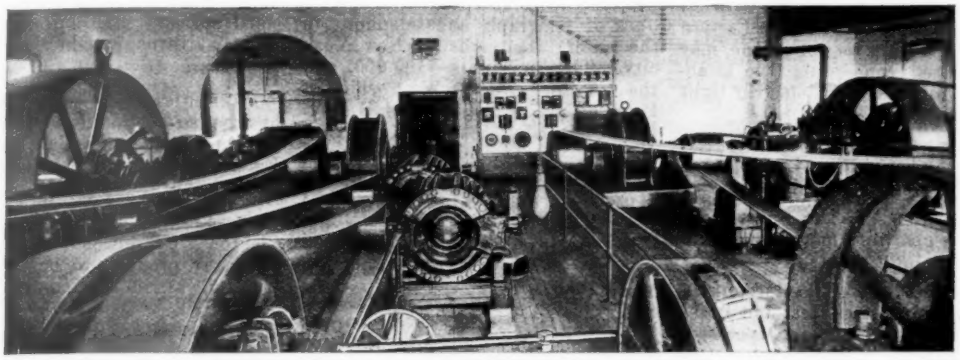


FIG. 1.—INTERIOR OF STATION.

In addition to the cycle factory, Mr. McKnight furnishes power to the tobacco factory of the P. J. Sorg Company, in which two departments are already equipped, each with a General Electric 30-horse-power induction motor. The first (Fig. 3) is the smoking-tobacco department, on the first floor, and is bolted to shafting, operating on the three floors above three Caldwell pickers, one cutter, two granulators and two dust machines. The second motor is on the sixth floor (Fig. 5), and is shown with the transformer and the meter to which the primaries from the station are connected. From this point secondaries are carried to motor No. 1 in the smoking-tobacco department, distant about 500 feet, and the lights in the different departments being tapped off before the motor is reached. Motor No. 2 drives two seven and one-half-inch Sturtevant fans, used to dry all the tobacco. It also operates a five-ton elevator. The capacity of the drying department is 100,000 pounds of tobacco daily.

The benefits of electric drive by induction motors are, perhaps, nowhere so forcibly demonstrated as in these two installations. In the cycle factory the constant speed of the machinery, the absence of vibration, and the power of the motors to respond to calls reaching as high as 50 per cent over their rated capacity, have enabled the manufacturers to give to every part of their wheels a perfect finish, as well as to greatly increase the output. In the tobacco factory the steady rate at which the tobacco passes through the dryers gives it a uniform cure. Previously the speed being variable, the tobacco would dry in spots only, and a second handling was almost always necessary. According to the foreman, the motor "saves him lots of time."

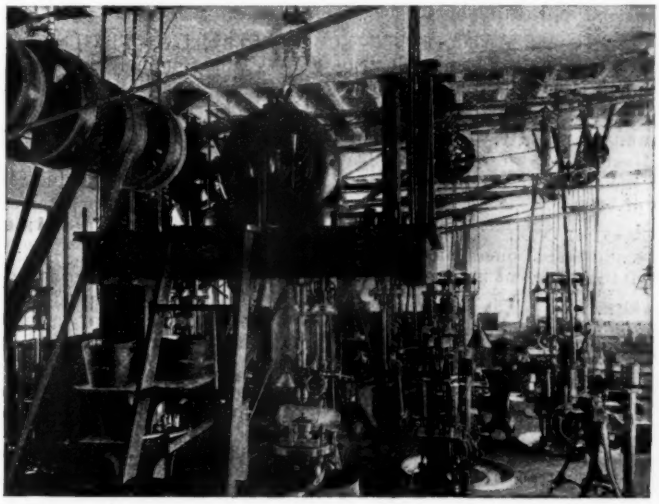


FIG. 4.—DRILL ROOM, MIAMI CYCLE AND MANUFACTURING COMPANY.

The incandescent lights in the town already wired number 3,800; of these 750 are in the cycle factory, 100 are in the tobacco factory, 650 are in the opera house, and 2,300 in other parts of the town. These lamps burn with absolutely no interference from change in the motor load; in fact, the entire motor load may be thrown on or off without in the least affecting the burning of the lamps, the presence of the motor load being usually only determined by reference to the ammeter. The monocyclic machines operate with almost perfect regulation, requiring little or no attention to maintain the constant potential at all times.

FIG. 3.—MOTOR NO. 1 IN THE FACTORY OF THE P. J. SORG COMPANY.

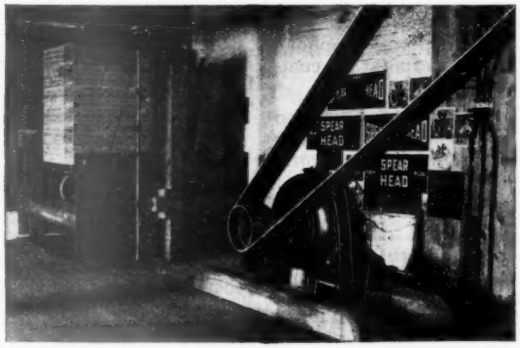


FIG. 5.—MOTOR NO. 2 IN THE FACTORY OF THE P. J. SORG COMPANY.

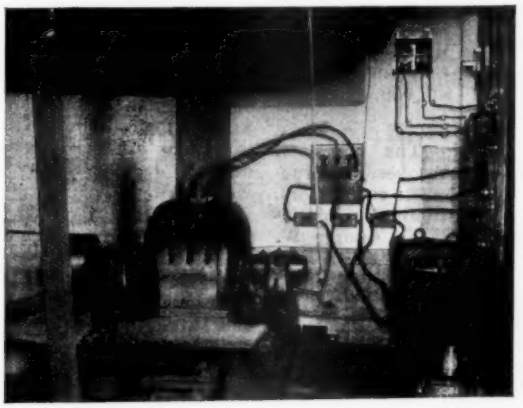


FIG. 2.—MOTOR NO. 2 IN THE FACTORY OF THE P. J. SORG COMPANY.

Benefits of Electric Railways.

A local newspaper observes that the street railway companies have added between $200,000,000 and $300,000,000 to the value of real estate in Chicago and its suburbs during the past 10 years; have expended nearly $150,000,000 in improvements and extensions; have spent between $3,000,000 and $4,000,000 in the building of bridges and viaducts, the repair, cleaning and policing of the streets, and have offered, in addition to all this, a share of their receipts to the city treasury, which would amount on an average to over $1,000,000 per annum, in return for the privileges they enjoy. But all this falls short of being "fair compensation" in the opinion of the newspaper trust, the professional reformers, the socialists and the anarchists.

You Are Right—We Apologize.

Some time ago I referred in complimentary terms to the change in form which had taken place in the ELECTRICAL REVIEW of New York. That paper quotes my remarks in full, but, extraordinary to relate, attributes them to *Lightning*, London. This is evidently due to a curious slip of the pen.—"*Elektron*," *in Electricity, London.*

ADVANCE INFORMATION

New Incorporations.

SOMERVILLE, N. J. — Frazeur & Company has been incorporated to manufacture speed and power appliances; capital, $100,000; corporators, David C. Frazeur and William J. Davis, of Newmarket, N. J.; John A. Frech, of Somerville, N. J.; George M. Frech, Jr., of Anandale, N. J., and Eddy L. Clark, of Dunellen, N. J.

SPRINGFIELD, ILL.—The Cosmopolitan Construction Company has been organized, with a capital stock of $500,000. The company has been organized for the purpose of building a power-house for the Cosmopolitan Electric Company and completing its system.

DULUTH, MINN. — The Duluth Fuel and Transfer Company has been incorporated; capital, $15,000; J. S. Sheridan, John F. McCarthy, F. A. Sheridan and James Sullivan, of Duluth, and John Fitzgibbon, of Sioux Falls, S. D., incorporators.

CHICAGO, ILL. — Illinois Electric Company has been incorporated; capital, $20,000; mercantile; incorporators, F. E. Healey, L. K. Cushing, Carl Keith.

HOUSTON, TEX.—The Pecos Railway Construction and Land Company, of Colorado; capital stock, $100,000; purposes, to construct, acquire and build a railway and telegraph line from Eddy County, N. M., to a point where the Pecos River crosses the boundary line; the principal office at Colorado Springs, Colo.; incorporators, William F. Greenwood, H. J. Hagerman, William H. Jones and others.

PHILADELPHIA, PA.—The Eastern Electrical Construction Company has been incorporated by W. D. Barnard; capital stock, $50,000.

ST. LOUIS, MO.—The E. Boggatt Manufacturing Company has been incorporated, with a capital stock of $25,000, to manufacture electrical appliances.

GRAND RAPIDS, MICH.—The M. B. Wheeler Electric Company, with a capital stock of $25,000, has been incorporated.

ORANGE, N. J.—The Electrical Wiring Company has been incorporated; capital, $15,000; corporators, Kurtz Eppley and William A. Johnson, of West Orange; George W. Euker and Adolph J. Levi, of East Orange, N. J., and Gustav A. Hornfeck, of Verona, N. J.

NEW YORK CITY — Commercial Lighting Company has been incorporated to furnish light by means of oil and to manufacture lamps, fixtures and appliances connected therewith; capital, $10,000; directors, Edmund Seymour, of 35 Wall street; James G. Dudley and Harry G. Strong, of New York city, and George W. Titcomb, of Brooklyn.

Electric Light and Power.

SHEFFIELD, ILL.—An electric light plant is to be established here at a cost of $5,000.

LEXINGTON, KY.—Dr. Edward M. Wiley, superintendent of the Eastern Kentucky asylum for the insane, may be addressed concerning the establishment of a $6,000 electric light plant for this building.

WESSON, MISS.—H. M. Buckley, Mayor, may be addressed concerning erection of electric light plant.

WATERTOWN, S. D.—Col. L. D. Lyon may give information concerning electric light plant.

JORDAN, N. Y.—The Jordan, Elbridge & Skaneateles Heat and Light Company has been incorporated; capital, $25,000; office, Jordan, Onondaga County; directors, Willard H. Tappan, T. Mitchell Foll, George E. Southard, Aaron P. Clark, Edwin Mitchell.

KAUFMAN, TEX. — The electric light plant is rapidly approaching completion, and will shortly be in operation.

BEEVILLE, TEX.—The new electric light plant is now in course of erection.

CARBONDALE, PA.—The Carbondale Heat and Power Company has been incorporated, with a capital stock of $100,000.

ELIZABETHTON, TENN.—The Mayor may be addressed concerning erection of a 400 incandescent light plant.

STARKE, FLA.—The Mayor may be addressed concerning erection of electric light plant.

PINE BLUFF, ARK.—W. P. Grace may give information concerning the erection of an electric light plant.

MARION, KY.—C. S. Munn & Company, contractors, may be addressed concerning construction of electric light plant.

GREENVILLE, MISS.—The Mayor may be addressed concerning erection of electric light plant.

CALDWELL, N. J.—The Newark Electric Light and Power Company, Newark, has been granted a franchise for lighting this borough.

DELFORD, N. J. — The Delford Electric Light Company; capital, $10,000; corporators, Kimball C. Atwood and John B. Lozier, of Oradell, N. J., and Hugh J. Grant, of New York.

GENEVA, N. Y. — Geneva Power and Light Company, of Geneva; capital, $50,000; directors; P. N. Nicholas and F. C. Bloodgood, of Geneva, and S. D. Greene, J. C. Carr and M. A. Oudin, of Schenectady.

MOUNT OLIVE, N. C.—J. D. Williams will build an electric light plant.

MOBILE, ALA.—The People's Light and Heat Company has been organized, with S. T. Prince, president; James K. Glennon, secretary and treasurer, for the purpose of lighting and heating by the Kitson hydrocarbon system.

New Telephone and Telegraph Companies.

ALBANY, N. Y.—The New Amsterdam Telegraph & Telephone Company has been incorporated to operate lines of telegraph and telephone in the several boroughs of New York city. The capital is $100,000, and the directors are H. W. Corbin, of Paterson, N. J.; Edward J. Leavy, F. B. Mullaby, Benson F. Currier, James F. Leavy, John J. Healy and A. E. C. King, of New York city.

WEST UNION, OHIO—The Central Union Telephone Company has decided to put up a line between Ripley and this place via Aberdeen and Manchester.

TUPPER LAKE, N. Y. — Tupper Lake Telephone Company has been incorporated, with a capital of $1,000, to operate in Franklin and St. Lawrence counties; directors, Nina L. Johnson, E. H. Johnson, Lillian M. Johnson, W. E. La Fountain, Rebecca H. La Fountain, William McLaughlin and Sarah McLaughlin, Altamont.

CROWLEY, LA.—The Postal Telegraph-Cable Company, of Texas, has been granted authority by the city, authorizing the construction and operation of a telegraph system in this place.

DECATUR, ALA.—Work has been begun on the long-distance telephone line from this place to Huntsville and Birmingham.

ATLANTIC, IOWA—Parties are in the city from Des Moines and Messena, Iowa, soliciting for the purpose of organizing a mutual telephone exchange.

ROCHESTER, N. Y.—Flower City Telegraph and Stock Company has been incorporated; capital, $10,000; directors, Lynn Hite, George W. Clark, J. E. O'Connor, W. P. Gorsline, B. J. Costello, B. Gorman and M. B. O'Connor, of this place.

SWEETWATER, TEX. — Neblett & Cox have closed contract for the construction of a telephone system.

CHASE CITY, VA. — W. H. L. Nelms will construct a telephone system.

MOULTRIE, GA.—J. F. Monk, W. H. Barber and others have received franchise for construction of telephone system, and will incorporate a company for the purpose.

CANADIAN, TEX.—The Canadian and Cheyenne Telephone Company has been incorporated, with a capital stock of $2,500, for the purpose of doing a general telephone business.

MACON, MO.—J. A. Hudson, of this city, has purchased the Columbia, Mo., telephone systems and will consolidate them. Improvements and extensions will be made.

New Electric Railways.

GARFIELD, N. J.—The Saddle River Traction Company has secured the necessary franchise and right of way to construct a road between this place and Lodi. It is expected that the line will be in operation by July 1.

CHICAGO, ILL.—Fred S. Comstock, of this place, has accepted the ordinance granting him a franchise to construct and maintain an electric railway through the streets of Kenosha.

FREDERICK, PA.—A company is to be organized to build an electric road from this place to Thurmont and Emmitsburg, with a future extension to Gettysburg.

ST. LOUIS, MO.—The St. Louis, Clayton & Creve Coeur Lake Railway Company proposes to build an electric railway in the suburbs of the city.

AURORA, ILL.—The owners of the Chicago and La Grange Electric Road are agitating the project of continuing the line to Aurora.

MUSKEGON, MICH. — An electric railroad to connect Muskegon, Grand Haven and Grand Rapids is now talked of. It will touch Ferrysburg, Nunica, Coopersville and Jennison.

BATTLE CREEK, MICH.—The contract for building the electric railway from this city to Gull Lake and Kalamazoo has been let to the New York Construction Company, of New York city.

IRONTON, OHIO — The Lawrence Telephone Company has been granted a telephone franchise in Russell.

MIFFLINGTOWN, PA.—The Tuscarora Telegraph and Telephone Company has been incorporated; capital, $3,000.

TOLEDO, OHIO—The telegraph line between this place and Columbus on the Hocking Valley line is being rebuilt.

Increase of Capital.

CHICAGO, ILL. — The American Electric Vehicle Company has increased its capital stock from $250,000 to $500,000.

MANSFIELD, OHIO — The Shelby Electric Company has increased its capital stock from $100,000 to $250,000. The factory will be doubled and the work of construction is to be begun at once.

MANSFIELD, OHIO—The Citizens' Electric Railway, Light and Power Company has increased its capital stock from $125,000 to $400,000.

Business Troubles.

PHILADELPHIA, PA.—A receiver has been appointed for the Acetylene Light, Heat and Power Company.

NEW YORK CITY—A deputy sheriff received an attachment on March 2 against the Imperial Electric Company, manufacturer of electric motors and lamps, of 140 Washington street, New York city, for $260 in favor of Thomas H. Williams, and an execution for $428 in favor of S. F. Jayne & Company; and a keeper has been placed in charge of the factory.

Amber, the First Source of Electricity.

Amber, the first discovered generator of electricity, is mainly found on the seacoast of the Baltic Ocean. It is fossil gum, originally the exudation of a species of conifer now extinct. This grew in luxuriant profusion hundreds of thousands of years ago on the marshy coasts of northern Europe, when the climate was much warmer than it is to-day.

The natural history of amber is thus explained. The immense forests of amber pine underwent their natural downfall and decay. The resin of the wood accumulated in large quantities in bogs and ponds and in the soil of the forest. Where the coast was slowly sinking, the sea by and by covered the land, and the amber, which had been gradually hardening, was at last deposited at the ocean bottom. But in higher regions the pines continued to flourish, and so amber would still continue to be washed down to the shore and deposited in the later-formed green sand and the still later-formed stratum of lignite or brown coal. The gum became fossilized by its long burial under ground.

More than 200 specimens of extinct life, animal and vegetable, have been found imbedded in amber specimens, says a recent writer in *Harpers' Round Table*, including insects, reptiles, plants, leaves, shells, fruit, etc., which had been caught in the liquid gum and entombed there for all time. Some of these specimens are so curiously beautiful as to be almost priceless, and one English collector has a cabinet of them which is valued at £100,000. One piece embalms a lizard about eight inches long, a little jeweled monster, perfect in its form and coloring, which has no like in anything existing now. Indeed, in many instances science is able solely through this medium to study details of animal life which perished from the earth many hundred thousand years ago. There are flies preserved with wings poised as if for flight, where the prismatic sheen glowing through the yellow sepulchre is as brilliant as if they were floating alive in the sunshine.

SAN FRANCISCO, CAL.—Reger & Atwater Company has been incorporated to deal in electrical and mechanical supplies; directors, A. P. Reger, William M. Reger, C. A. Reger, M. E. Reger and R. D. Duke, all of San Francisco; capital stock, $25,000.

Kindred.... ...Interests

The H. B. Camp Company, the well known manufacturers of conduit, Aultman, Ohio, have opened a New York office at 15 Dey street, which will be in charge of Mr. Henry H. Camp. This company is doing a very extensive business in vitrified clay conduit pipe for underground electric wire.

The Western Electric Company has recently opened a branch office in the Security Building, St. Louis, in charge of Mr. Irvine S. Jackson, who will devote his entire attention to the business in that city and the surrounding territory. This office will be furnished with every convenience for meeting the large requirements of the trade, both as regards prompt delivery of goods and satisfactory prices.

The Berlin Iron Bridge Company, of East Berlin, Ct., have the contract for building a new power-house, carbarn and steel bridges for the Port Jervis Electric Railway Company, Port Jervis, N. Y. The buildings will be of a very substantial character, entirely fireproof, covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron. The bridges are plate-girder type, constructed in a substantial manner for carrying the heaviest loads.

The Automatic Switch Company, fo Baltimore, Md., are having a very successful sale of their improved motor-driven starter. The action of the starter is made automatic by the use of centrifugal force, and the movement of the contact rod is governed by a positive thrust taken from the pulley, thus avoiding the danger of variations in the starting of the machine. The absence of dash-pots, solenoids and magnets tend to make the apparatus particularly reliable.

The Peru Electric Manufacturing Company, of Peru, Ind., are placing on the market a new transformer fuse plug that promises to be a great success. The plug is made of vitrified porcelain and can be placed with perfect safety in all kinds of weather. The simplicity of its construction and its extreme length allow the possibility of an extra long fuse. The company have recently established a branch office at 220 Broadway, New York city, in the charge of Mr. F. H. Schleshinger, and report a very good business from that department.

The Davis & Egan Machine Tool Company, of Cincinnati, Ohio, have, during the past week, received a number of large orders through their office at Berlin, Germany. Among them was one from the Bayreuther Maschinen Fabrik at Bayreuth, near Düseldorf, for a number of upright drill presses, radial drills, 36-inch lathes and bolt-cutters. They are the largest builders of electric cranes and hoists in Europe. Also one from the Locomotiv Fabrik Maffei at Munich, Germany, for a number of large engine lathes.

The McCay-Howard Engineering Company, of Baltimore, Md., are introducing an improved reaction coil to be used for the purpose of regulating the speed of motor fans. It is not necessary to have the switch directly connected with the fan, but it can be placed in a convenient position on the wall. It is quite a current saver. With the motor running at full speed the switch is entirely cut out and the current fed directly to the fan. The coil is regulated at four speeds, ranging gradually from 50 to 150 revolutions per minute.

The increase of business at the Atlas Engine Works, of Indianapolis, during the past three months has been greater than any similar months for five years. They report the following orders: Twenty-eight 14 by 24-inch engines for use in the plant of the Pittsburgh Plate-Glass Company, Pittsburgh, Pa.; three 150-horse-power engines for the Spreckles Sugar Company, San Francisco, Cal., and also eight 70-horse-power portable engines for the enlarged plant of the same firm. The company are now introducing in the field a new improved Atlas-Corliss engine.

The Garton-Daniels Electric Company, of Keokuk, Iowa, are enjoying, almost beyond expectations, the full extent of prosperity, as is evidenced by the increase in their sales. Their goods are becoming more thoroughly established, are being used by manufacturers of generators and motors, and by a large number of the leading street railways and electric light companies. They also sell a large number of lightning arresters for protection of stationery motors, the Garton proving splendidly suited for this purpose. A new descriptive circular, which will be mailed upon application, has just been issued.

The interest taken in electrical exhibitions is by no means limited to Greater New York, but extends in every direction. Numerous comments have been made by the foreign press and by journals in different parts of the country, and Prof. R. B. Owens, director-general of the electrical work at the Omaha Exposition, beginning in June, has been specially instructed to visit this city in May and acquaint himself with the exhibits and the work being done. Many inquiries have come from foreign managers and manufacturers as to the time and nature of the exhibition, and it is a fact beyond question that a direct stimulus will be given to export trade. As was the case at the exhibition in 1896, many of the exhibits will go straight from the floor to foreign countries.

The Tuerk alternating-current fan, which the Western Electric Company is handling, has very successful features to recommend it. This ceiling fan is strong, reliable and noiseless; is manufactured for all alternating-current circuits; is of the induction type; has no commutator and no brushes; is of the highest economy; has self-oiling bearings and adjustable blades, and the starting switch is in the base of the motor within easy reach and access. The motor is ornamental, inexpensive to operate, and, it is claimed, delivers more air for the same consumption of energy than any other alternating-current fan on the market. The Western Electric Company, Chicago, will be pleased to send catalogues and give prices and information regarding the Tuerk alternating-current ceiling fan motor at any time.

The rapid increase in the number of independent telephone exchanges has made the telephone supply business a very important item in the business of all the electrical supply companies. One of the items used by the telephone companies, for which there has been quite a large demand, is that of rubber-covered telephone cables. The Paranite telephone cables,

J. C. WHITE & COMPANY,
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ENGINEERS, CONTRACTORS,
29 BROADWAY, NEW YORK, N. Y.
EQUITABLE BLDG., BALTIMORE.

NAGLE & BALL, CONSULTING ENGINEERS.
PLANS, SPECIFICATIONS, REPORTS, DESIGNS.....
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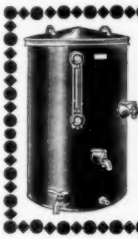
DIRECT-READING AMMETERS OR VOLTMETERS,
Like cut, reading from 0 to 10, at $1.50 each. 0-25 at $5.00 each.
Cherry Electric Works,
25 & 27 3d Avenue, NEW YORK.


The CROSS OIL FILTER
actually reduces oil bills 50 per cent. or more. Sent on approval. Capacities ranging from 3 to 120 gals. per day. Used in 17 countries. It is specially adapted to Electric Light and Power Plants. Established eight successful years.
The BURT MANUFACTURING CO., Akron, O., U. S. A.
P. O. Box 133. Largest Manufacturers of Oil Filters in the World.

which are being sold in the West by the Electric Appliance Company, of Chicago, are securing a very high reputation among telephone people. The Electric Appliance Company are in a position to make the most prompt delivery on these telephone cables for the reason that they represent the only rubber covered wire factory located in the West. They are thus enabled to ship any ordinary order for special telephone cables from their Indiana factory within a very few days after the receipt of the same, which makes an unusually prompt delivery for this class of material. The Electric Appliance Company are always pleased to submit samples at any time of what they are producing in this line.

The fan motor catalogue just issued by the General Electric Company is a handsome bit of printing, effectively calling attention to their complete line of breeze-makers.

"Electric Launches" is the title of a dainty catalogue issued by the Electric Launch Company, Morris Heights, New York city, describing the latest types of these effective and useful craft.

Goldmark & Wallace, 121 Worth street, New York, are the agents for the Eck dynamos and motors. Their hurricane fan motors are well finished, noiseless and durable. Circulars giving prices are sent on request.

Removal Notice—After March 31, 1898, the Boston office of the Pennsylvania Steel Company will be at Rooms 11 and 12 Mason Building, 70 Kilby street, corner of Milk street. Mr. Charles S. Clark is the popular sales agent.

The Electrical Manufacturing Company, of 329 Fourth avenue, New York, report numerous orders in the line of their electrical novelties. The company have also brought their miniature lamp to a high state of perfection, and are now engaged in getting up some new designs of the lamp.

The Electrical Exchange, Chicago, makes a particularly attractive proposition in the ELECTRICAL REVIEW this week to users of incandescent lamps. A high-grade lamp, in barrel lots at 15 cents each, with no charge for boxing and cartage, is the offer. The lamp is guaranteed by this enterprising house and the offer continues for 60 days.

The Walker Company has recently secured a very handsome and commodious suite of offices on the sixteenth floor of the Commercial Cable Building, 18–20 Broad street, New York. The suite includes a private hall, general offices, private offices for the officials of the company, and all the latest conveniences for the modern transaction of business.

Others have the same experience—A Pennsylvania patron of the advertising columns of the ELECTRICAL REVIEW sends the following message: "Tell the editor of ELECTRICAL REVIEW that my advertising in his journal has really been of more service and caused more inquiry and comment than that of any other journal in which I have advertised."

Swett & Lewis Company have recently issued a carefully-gotten-up booklet, designated as bulletin No. 22, descriptive of static machines, and their application for Roentgen-ray and therapeutical work. This company's offices are at 11 Bromfield street, Boston, and the pamphlet will be sent to those who make inquiry, mentioning the ELECTRICAL REVIEW.

The Commercial Electric Company, of Indianapolis, Ind., are at present perfecting an enclosed motor with the idea of excluding as much as possible the collection of dust, which is likely to become incrusted on the shafts when the motor is situated in any mill or other place where there is a great amount of siftings, etc. The machine can be connected to the ceiling if desired, thereby saving floor space. The company announce a general increase of business at the present time, with the prospect of a further increase.

Three important contracts have recently been closed by the Washburn & Moen Manufacturing Company, as follows: The contract for the underground lighting cables for the Chicago West Park system; this is the second order which this company has received from this Chicago company. An order for the entire underground cable for the Imperial Electric Light, Heat and Power Company, of St. Louis, and the contract for the cable which is to be used for transmitting power from Chambley Rapids to Montreal. This is to be a very high-voltage cable for lighting purposes. It is said by the management of the Washburn & Moen Manufacturing Company that the plant at Worcester is operating night and day.

The American Electric Telephone Company, Chicago, have secured a very large contract covering apparatus for 3,000 instruments for the Saginaw Valley Telephone Company. This company is to put in an underground system at Saginaw, Flint, Bay City and West Bay City. This apparatus was selected after a very exhaustive test of all apparatus on the market and after the committees had visited a number of the large installations using independent apparatus. The American company have just expressed to Seattle a 100-number express style switchboard complete, and 100 telephones to be used by a company at Dawson City, N. W. T. This apparatus is all packed in very narrow boxes, so that it can be placed on sleds and carried through the passes successfully and quickly.

The Kinloch Telephone Company, in St. Louis, which is so widely known in telephone circles throughout the entire country, and which is composed of some of the very best business men and citizens of St. Louis, recently closed a yearly contract with the Phœnix Carbon Manufacturing Company of that city for all of their batteries and component parts. The Kinloch company from their incipiency determined to use only the very best in all parts of their work, and the magnitude of their wants caused interest by manufacturers from all sections of the country. After months of labor spent in making tests by scientific men of the profession, they decided that the Phœnix No. 1 porous cup cell filled all of their requirements and was the best obtainable, hence the placing of their contract. The Phœnix Carbon Manufacturing Company have made extensive improvements and largely increased their facilities, and are now in position to deliver batteries of this or any other type in any quantities that may be desired, and their product in all departments is recognized as among the best.

Among the foreign orders recently received by the Walker Company may be mentioned, 20 double No. 3 S street-car equipments, three single No. 3 S and 18 No. 3 N. equipments for Paris, besides four 150-kilowatt belted generators with two generator panels. Messrs. Bagnall & Hilles, of Yokohama, have ordered two 25-kilowatt direct-connected generators for Singapore. Recent domestic orders include two 150-kilowatt three-phase synchronous motors for the Lachine Rapids Power Company, a 700-kilowatt alternator, single-phase, for the Buffalo & Niagara Falls Electric Light and Power Company, and one 120-kilowatt belted generator for the Northern Electric Company, of Baltimore, and two 400-kilowatt belted generators for the Syracuse Construction Company. The Norton & Attleboro Railroad, of Attleboro, Mass., has purchased four double No. 4 A S and two double No. 5 S equipments, besides a 250-kilowatt direct-connected railway generator. Besides the generator above referred to the Northern Electric Company, of Baltimore, has 100 Walker arc lamps, making in all 300 in three months.

The company has also recently taken a contract from the government to build three disappearing-gun carriages for eight-inch rifles; they are to be of the Crozier type, 1896 model.

SALESMEN

who are interested in handling a side line, selling to electrical houses, write to the

PACIFIC ELECTRIC CO.,
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CORRESPONDENCE IS SOLICITED

from managers or superintendents of electric lighting and water-works plants, and with parties in need of a man who is thoroughly competent to secure best results. Seven years of experience in this line of work in towns of 3,000 to 5,000. Can design, build or rebuild plants and guarantee results. Can make accurate tests of any kind. Business systematically conducted. Write for references. Address "SUPT.," care ELECTRICAL REVIEW, N. Y.

ADVERTISERS with first-class connection and highest references are prepared to accept sole agency for first-class electric traction material and accessories.

MARRYAT & PLACE,
Hatton Garden, London, England.

FOR SALE—AT A BARGAIN.

Two M. P. Railway Generators, 175 H.-P.; speed, 550 revolutions for 550 volts; also 220 and 110-volt dynamos and motors, switches and instruments. Apply to

F. A. BAUX,
1002 Chamber of Commerce Building, Chicago.

WANTED.—Position with Electrical Manufacturing Company. Graduate of technical school; experienced in installation of electrical and steam apparatus.

Address "C. W. P."
Care ELECTRICAL REVIEW, N. Y.

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to sell a patented device which should be applied to every street car in the country. For full particulars, apply to

CHARLES A. MANN,
BANGOR, ME.

Bargains in Dynamos, Engines, Etc.

Direct-current dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,350, 1,610 and 2,500 light capacity.
Alternating-current dynamos of 750, 900, 1,300 and 2,000 light capacity.
Arc dynamos, 20, 24, 30, 40, 50 and 60 lights, both 1,200 and 2,000 candle-power.
Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 horse-power.
Boilers, 100, 250, 375 and 500 horse-power.
Heaters, 150 and 2,000 horse-power.
Pumps, all sizes.

Write us for Price-list No. 21.

This apparatus has been removed from our own Central Stations to make room for larger units. We therefore know its history and can guarantee it to be in thoroughly good operative condition.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED MARCH 29, 1898

601,233 System of electrical distribution; W. L. Bliss, Brooklyn, N. Y.—The hereindescribed method of controlling the current and electro-motive force of a dynamo, consisting in demagnetizing the field of said dynamo, as the speed and electro-motive force of said dynamo increase, by means of an auxiliary counter electro-motive force, which increases as the speed and electro-motive force increase, and which is connected in series with the primary exciting field coil of the dynamo.

601,256 Maximum meter; A. H. Hoyt, Penacook, N. H.—In a thermal registering maximum meter, two strips of thin metal covering opposite sides of the heating area of the thermal tube and electrically connected in parallel, and similarly connected to the stationary and movable parts of the instrument.

601,268 Electric arc lamp; P. F. Krug, New York, N. Y.—In an electric arc lamp, the combination with a supporting stand, of a supporting arm provided with a movable fulcrum bearing against said stand, carbon-holders, means for supporting and adjusting the carbon-holders, and means for setting and adjusting the supporting arm and its fulcrum.

601,276 Electric switch; O. S. Platt, Bridgeport, Ct.

601,286 Fusible cut-out; F. Schwedtmann, St. Louis, Mo.—In a fusible cut-out, a suitable box or casing of insulating material, line-wire terminals carried thereby, a removable fuse-carrying member in said box or casing, fuse terminals carried by said fuse-carrying member and adapted to be put in electrical communication with the line-wire terminals, and a removable protecting cover for said line-wire terminals at the side of the said casing opposite said fuse-carrying member.

601,301 Safety device for electric elevators; J. D. Ihlder, Yonkers, N. Y.—In an electric elevator, the combination with the car and motor therefor, of a safety magnet brake device, a circuit including the magnet thereof, a switch included in said circuit, and a slack-rope device connected to said switch.

601,318 Regulator for organs having electrical air-pumps; L. K. Fuller Brattleborough, Vt.

601,351 Electric lighter for gas burners; L. V. Lewitzki, Brussels, Belgium.

601,396 Cataphoric electrode support; M. W. Hollingsworth, Philadelphia, Pa.—In a cataphoric electrode support, the combination of the interdental clamp, means for operating the said clamp, an electrode-holder adjustably connected to said means.

601,454 Clamping buckle for electric line wires; A. H. Weikman, Palmyra, N. J.—In a buckle for attaching electric line wires to insulators, the elastic fulcrum wire adapted to embrace an insulator, and having open projecting ends in combination with a lever pivotally connected therewith, and a clamping bail adapted to bend the line wire over the projecting ends of the fulcrum wire, and bind the line wire to the insulator.

601,458 Electric rail bond; F. W. Atkinson, Chicago, Ill.—An electric rail bond, consisting of two or more strips of wire which are bent together into two angles to approximate the form of the letter Z, and terminally held together in the same plane by securing rivets.

601,471 Storage battery; C. S. Kaufmann, Chicago, Ill.—In a storage battery cell, the combination of plates, insulating supports arranged between them and provided with T-shaped lower ends and a longitudinal channel or channels, and pins projecting from the faces of some of the plates with their ends received into the grooves or channels of the insulating supports.

601,482 Electric railway signaling system; B. Samuels, St. Joseph, Mo.

601,492 Automatic cut-out; H. F. Blackwell, Jr., Brooklyn, N. Y.—An automatic cut-out for an electric circuit, comprising a spring-actuated arm forming a conductor, a link connected at one end to the arm, and at the other to a part insulated from arm and a carbon point in the circuit and engaging with the link and adapted to separate the link when heated by an excessive current.

601,585 Electric heater; J. F. McElroy, Albany, N. Y.

601,588 Rheostat; F. E. Pool, Quincy, Ill.—The combination of a feed-wire terminal, a pivoted lever having one end in engagement with said terminal, stationary contact pins, and a roller linked to said lever and terminal and adapted to rest on said contact pins.

INDUSTRIAL NOTES.

The K. & W. Company, of Pittsfield, Mass., report a fine trade in their lamps and hanger boards. They are receiving orders from all sections of the country, and many flattering testimonials as to the good qualities of the Hardy lamp.

If the advance sales of fan motors by the Central Electric Company can be considered as a criterion, we may expect a very hot Summer. The indications are that the name "Windy City" will be fully vindicated, judging from the number of Lundell desk and ceiling fans and other wind-producing devices shipped by this popular supply house.

Miller-Knoblock Company—Some commutators need more lubrication than others, and the liberal use of some good compound is almost imperative with certain makes. The Miller-Knoblock Company's commutators are reported as causing quite a saving in that respect, on account of the absolute uniformity in texture and homogeneity of the copper used in their construction. It is the small items that help swell the expense account around a station.

St. Louis Electrical Supply Company—Beginning April 1 this well known supply house will be under a new management, composed of Messrs. W. N. Mathews, president and treasurer, and Russell Stanhope, vice-president and secretary. As is generally known, the company carries a most complete line of electrical supplies of every description, and will continue to supply the demand of a discriminating trade in the prompt and satisfactory manner for which it is noted.

Business with the Columbia Incandescent Lamp Company, St. Louis, for the first three months of 1898 shows an increase of over 50 per cent over the corresponding months of last year, in spite of the approaching dull season in the lamp business. This remarkable showing, Mr. Garrison states, he believes due to a general revival of business, the increasing popularity of the Columbia lamp, and last, but not least, to persistent and judicious advertising.

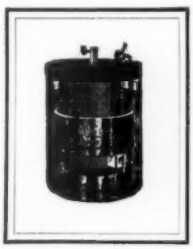
Wm. Wurdack, electrical contractor, St. Louis, has recently completed several important contracts in the West. Among them may be mentioned the entire rewiring of the Laclede Hotel, and its equipment with several large motors. In brewery work Mr. Wurdack is gaining quite a reputation for high-class work, a 40-kilowatt Triumph generator (for which Mr. Wurdack is agent) in the Green Tree brewery and a 25-kilowatt machine for the Cherokee brewery being among last week's orders.

E. Ruebel & Company — Mr. Ernst Ruebel, who has been identified with the St. Louis Electrical Supply Company as president and general manager, has severed his connection with that concern, and will hereafter continue in business under the firm name of E. Ruebel & Company. The causes which led to Mr. Ruebel's new departure were mainly a desire on his part to follow more closely the technical and mechanical lines of the business. The new firm will make a specialty of catering to those who desire a high grade of special devices in the field. Among the many good things already secured by them may be mentioned the Bullock Electric Company's line of dynamos and motors. In addition, the company will continue to manufacture a first-class line of telephones and transmitters, arc lamps for special purposes and other devices.

LYONS & BISSING.

MR. JOSEPH LYONS, Electrical Expert and Solicitor, and *MR. GUSTAV BISSING, late Principal Examiner of Electrical Division A, U. S. Patent Office,* announce the formation of a partnership for the general practice of PATENT LAW, with its offices at the McGill Building, WASHINGTON, D. C.

GORDON PRIMARY CELL



The increasing popularity of the Gordon Primary Cell among the Fire Alarm and Police Signal Service of the leading cities, the railroad, telegraph and telephone companies, and the general adoption of our steel enameled cell for gas-engine, launch and marine service attest most highly to its merit, efficiency, adaptability and economic features.

If you wish to read the testimonials in its behalf, and learn its full description, kindly apply for circular and price list, to

GORDON-BURNHAM BATTERY CO.,
82 to 86 WEST BROADWAY, NEW YORK CITY.

THE BURNLEY DRY BATTERY

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Signs are already visible of the keen spirit of rivalry which has been aroused in telegraphic circles by the announcement of the coming tournament. Already the cracks in many cities, both in the States and in Canada, are getting themselves into training. Some of the Montreal operators have written to ask whether they will have the same show as their American competitors. The reply they received assured them that they would have an open field and fair play, and they are now busy getting their contingent in racing form. In other cities, such, for instance, as Chicago and Philadelphia, the telegraphic fraternities are uniting to raise additional prizes to be given to the successful contestant from their city at the tournament.

The complete list of judges includes the names of A. S. Brown, electrician, Western Union Telegraph Company; Francis W. Jones, electrician, Postal Telegraph Company, and others as follows: A. E. Sink, Chas. Shirley, Geo. H. Usher, D. B. Mitchell, Minor M. Davis, Gardner Irving, S. F. Austin, P. J. Tierney, F. F. Horton, S. A. Coleman, E. F. Cummings, Edwin F. Howell, E. T. Barberie, Chas. Thom, E. H. Cox, manager, and E. W. H. Cogley, Thos. R. Taltavall, E. A. Leslie, J. H. Bunnell, H. W. Pope, Wm. Maver, Jr., Robt. W Martin, P. B. Delany, Edward H. Johnson and Thos. J. Smith; judges of press code, Ed. H. Curlette and P. T. Brady.

All these judges are expert telegraphers. The selection has been so carefully made, and the list includes so many men in the front of the electrical as well as the telegraphic industry, that every contestant may be assured that his individual interests will be protected. Phonographic and other records of each transmission will be made, so that in the event of any dispute the work may be reproduced.

The judges of the typewriting contest are Chas. W. Price, editor ELECTRICAL REVIEW; T. C. Martin, editor *Electrical Engineer*; W. D. Weaver, editor *American Electrician*; J. B. Taltavall, editor *Telegraph Age*, and G. H. Guy, secretary New York Electrical Society.

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Electricity at the Columbian Exposition, however, lives not only in the memories of the people who have seen it, but also in a more substantial form in the shape of a five-hundred-page book compiled by John P. Barrett. This book, "Electricity at the Columbian Exposition," contains eighty-four handsome full-page illustrations, sixteen of which show exterior views of the buildings at night. The brilliant illumination of the buildings by both incandescent and arc lights made it not only possible to photograph them after nightfall, but also gave unique and artistic results. Seventeen of the full-page illustrations are general views giving pictures of the fountains and statuary, and there are also fifty full-page pictures of the various exhibits.

The paper used in this book is finely finished enameled book paper, which allows for the best effect in printing illustrations. The text is generally descriptive of the various exhibits and of the buildings, and also contains several reports of the expenses and the operation of the intramural railway, and several short historical introductions to the descriptions of the various departments of electricity.

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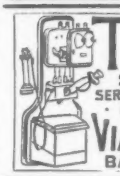

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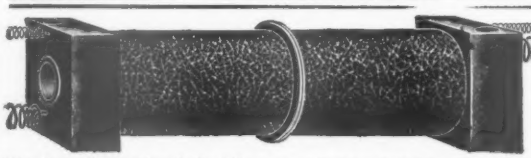

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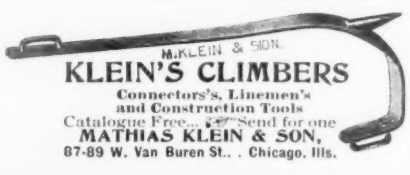

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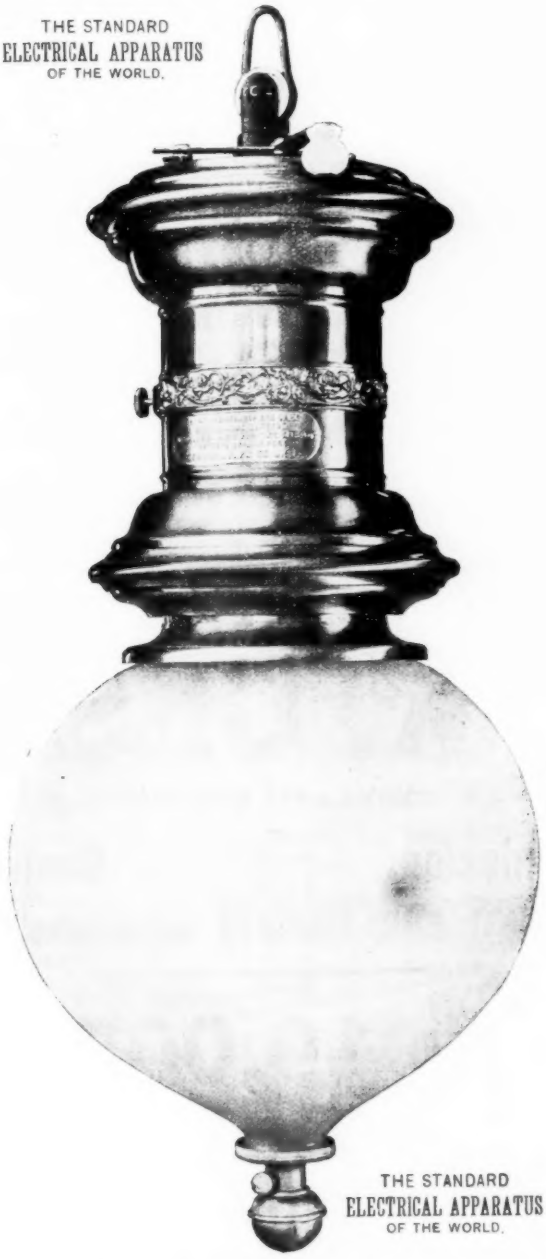

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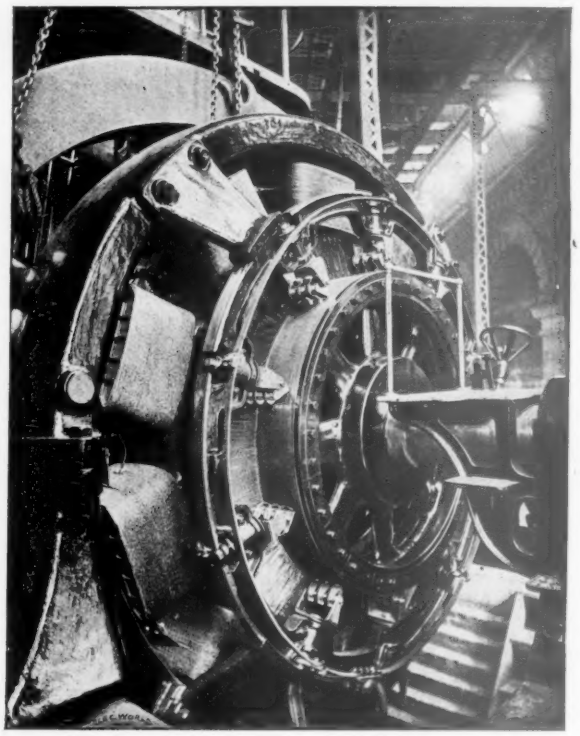

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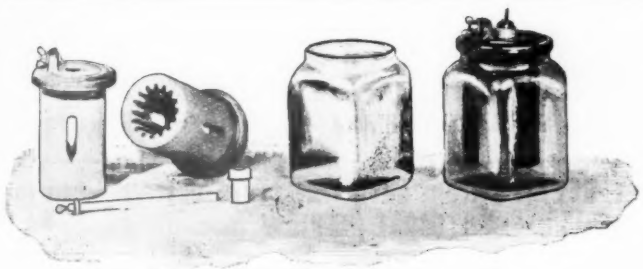

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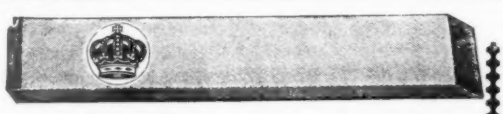

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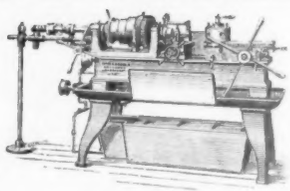

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Garton-Daniels Electric Co.

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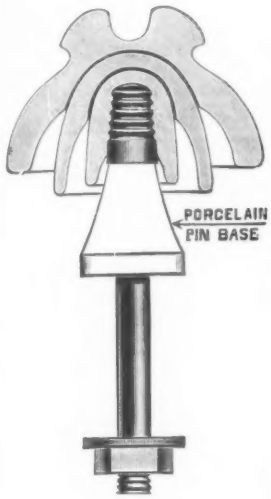

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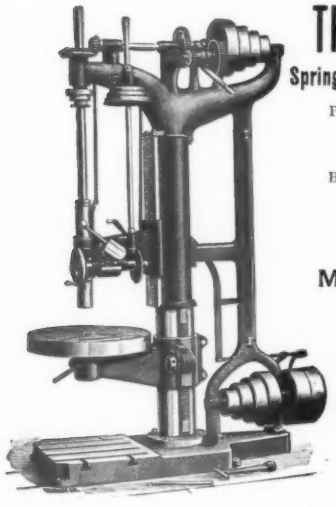

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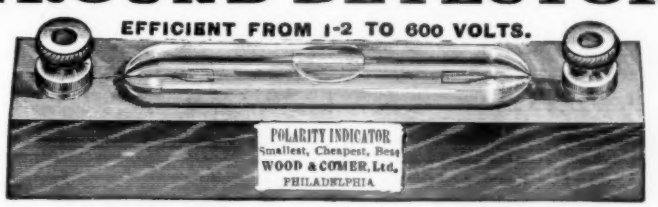

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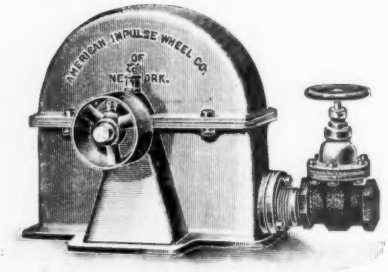

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